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ELECTRICAL WORLD

McGraw-Hill Publishing Company, Inc.

FEBRUARY 27, 1932
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When Industry Curtails

THE necessity for reducing expenditures has caused some large purchasers to dispense, entirely or in part, with precautions for insuring good quality of materials and apparatus purchased. As an emergency measure it is apparently considered necessary to take a chance. And the chance of ill results may be deemed to be small because purchases are made from reliable producers who supply good products and have a reputation to maintain.

It is a regrettable fact, however, that these same producers are likewise faced by a necessity for curtailment of expenditures, quite as are the purchasers. They too are seeking to reduce expenses and find in inspections and tests, not immediately and essentially related to production cost, a place where expenditures can be lopped off. They too may find it necessary to take a chance.

In reduction of expenditures for quality control by both purchaser and producer there is an opportunity for unfortunate results of a serious character. There is also an opportunity for avoiding these results ready at hand. Electrical Testing Laboratories, with its wide experience in testing and inspection and with its competent staff is in position to supply a service which in many cases may be exactly what is needed to safeguard the situation. Specializing in such work, it too has a reputation for effectiveness to maintain. In many lines it ought to be able to render a more effective service than a purchaser can obtain through his own efforts. And especially where the logical plan is followed of dividing the cost between the purchaser and the producer, the service becomes available at an attractively low price.

To those who have found it necessary to curtail their own inspection and testing activities, E.T.L. service is offered to supplement those testing activities which have been retained and to furnish a partial or complete equivalent of those which have been abandoned. E.T.L. charges only for services rendered. There is no expense to clients when service is not being used. E.T.L. does not proffer a perfunctory inspection—it offers a constructive service, helpful to purchaser and producer alike in arriving at the best practicable quality at the lowest price consistent therewith.

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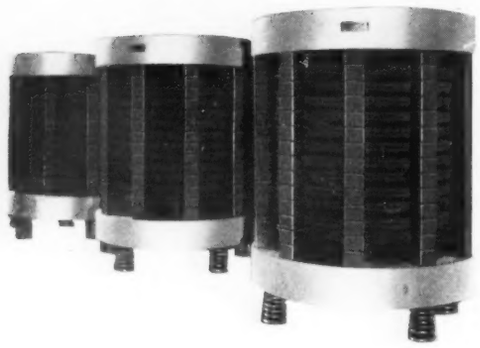

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Kings County Gas & Elec. Co., Brooklyn
New York Edison Co.
Philadelphia Electric Co.
Southern Wisconsin Power Co.
Turners Falls Power Co., Mass.
Utica Gas & Electric Co.
Youngstown Sheet & Tube Co.
Calgary Municipal Elec. Co.
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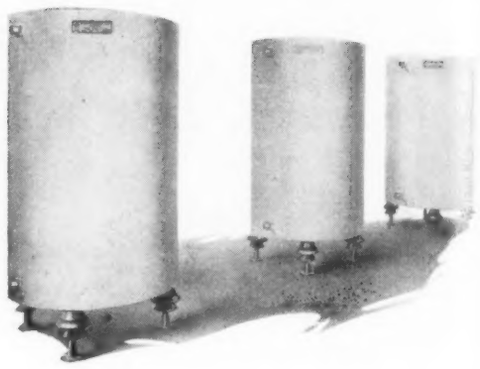

Installations

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National Tube Co.
American Brown Boveri Corp.
Northwestern Electric Co., Portland Ore.
City of Tacoma
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Allied Engineers, Inc.
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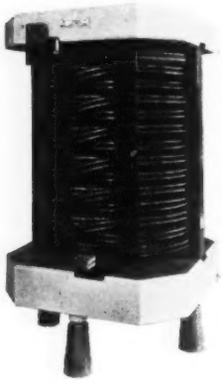

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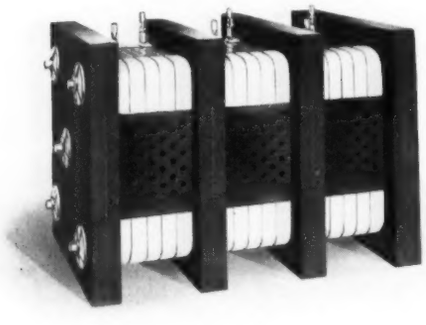

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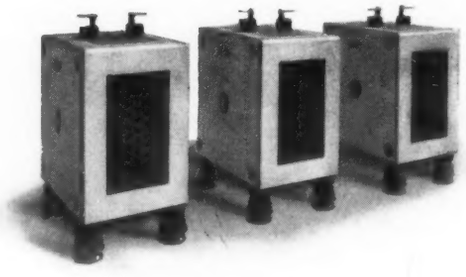

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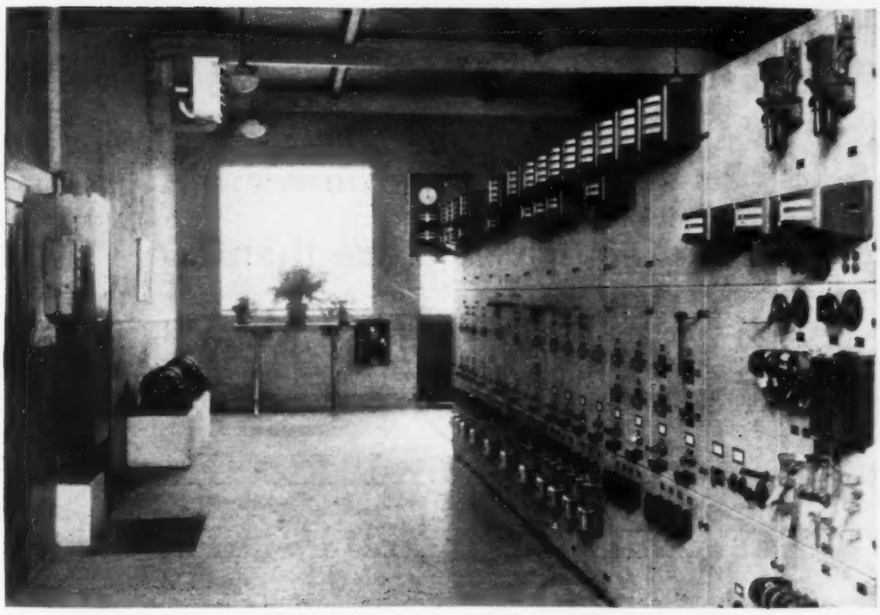

Ivanhoe substation Appalachian Electric Power Company

FEBRUARY 27, 1932

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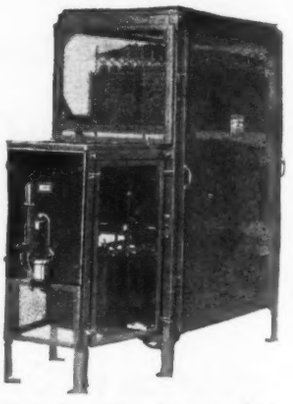

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GENERAL ELECTRIC

850-26

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

February 27, 1932

It is the duty of a commissioner not merely to sit back and listen to complaints, but to keep an active supervising eye on the operations of the public utilities under his jurisdiction.

DAVID E. LILIENTHAL,
Member Public Service Commission
of Wisconsin

[Mr. Lilienthal carries out his ideas of aggressive regulation—pp. 385 and 403.]

Steel, gas and power industries linked

—**Regional energy co-ordination** in Chicago district embraces steel, gas and power industries. Blending of energy structures results in economies to all industries participating—*p. 406.*

—**Legislation or co-operation?** Those are the alternatives in utility appliance selling, points out W. H. Hodge, Byllesby vice-president. Opinions of 68 Kansas editors summarized—*p. 416.*

Relays important in system planning

—**Typical relay problems solved** by sixteen leading protection engineers show local modifying factors to be quite as important as the simple circuit conditions. Ground and distance relays appear to be the trend—*p. 398.*

—**Interference responsibility** shifted in a large measure to the radio-receiver owner by Los Angeles ordinance. Specific provisions to avoid interference must be observed by the receiver-owner who complains—*p. 385.*

Britain continues electrical advance

—**Review of 1931 engineering** shows British to be alert for new developments. Another 36,000-volt alternator, a 132,000/400 volt transformer design and condensers on the turbine floor level are some features—*p. 386.*

—**Electric conveyors in tunnel** bring all the advantages of continuous material handling without adding to hazards of underwater construction. First installation is successfully made in new Boston tunnel—*p. 392.*

Indiana commission wins Martinsville case

p. 382.

—**Accounting serves regulation** by facilitating rate analyses, tracing of property acquisition costs and other such items in Wisconsin. Recent order of state commission explained—*p. 403.*

—**Hardy Dam goes on the line.** New station of Consumers Power Company on the Muskegon River, Mich. This 30,000-kw. project with three units is of the earth-embankment type—*p. 412.*

Municipality, Not District, Is Unit for Fixing Rate Base

Martinsville (Ind.) case decided adversely to utility by United States court.

Only property "used and useful" in community may be considered by regulatory commission.

AN IMPORTANT principle in utility rate making which provides that only property of immediate usefulness in serving a community shall be counted in the valuation on which rates are based has been upheld in the federal courts in Indianapolis, where a three-judge tribunal has just dismissed a temporary injunction obtained to prevent the Indiana Public Service Commission from entering a reduction in rates in the city of Martinsville.

This decision is in accordance with the views of the special master appointed by United States court authority and previously reported (ELECTRICAL WORLD, July 18, 1931, page 93).

The opinion denied the contention of the Wabash Valley Electric Company, an Insull utility, that its entire property should be used as a basis for rates in Martinsville. It pointed out that the company received more than a 7 per cent return on the property "used and useful" in supplying service to Martinsville and denied that the lower schedule of rates was confiscatory. The order likewise provided for the return to Martinsville consumers of all sums of money collected in excess of those which the firm would have collected under the disputed schedule of rates.

Frank T. Singleton, a member of the commission, declared that the court decision is one of the most important court utility decisions ever handed down. Attorneys for the utility would not state whether they would appeal the case to the Circuit Court of Appeals in Chicago.

Part of the court's findings are as follows:

To give it [an Indiana statute provision requiring the commission to value "all the property" of a utility in fixing rates] any other construction would make the very law which was enacted for the benefit of the utility prohibitive from the viewpoint of the public. It would make it necessary to have all the property of the entire system appraised each time a single municipality or ten or more of its citizens petitioned the defendant commission for a revision of its rates.

The expense alone, if allowed to be taxed as an operating expense, as contended by plaintiff, would be so great that in many if not every instance it would result in an increase instead of a reduction in rates.

There has been no change or modification of this act in so far as the above provisions are concerned, and it must therefore be concluded that it was the intention of the Legislature that the municipality should be the unit in determining the just and reasonable rates to be paid any public utility by it and its inhabitants. Many legislatures have convened subsequent to the passage of this act, but none has seen fit to change or modify it in that particular.

Whether any division of the state other than a municipality shall be designated as a unit for the purpose of fixing rates for a utility is a matter of public policy to be exercised by the Legislature.

Until that is done neither the Public Service Commission nor a court can consider any other unit than that which is now fixed by the Legislature, namely, the municipality, in establishing a schedule of rates for the services of a utility in such municipality.

▼

Consolidated Gas to Seek to Add New Taxes to Rates

An indication of the policy likely to be followed by light and power companies in all parts of the country in the event that a tax on domestic energy such as the 7 per cent impost recommended by the Treasury Department shall be imposed by Congress may be found in a significant statement made by President George B. Cortelyou of the Consolidated Gas Company, New York, in the course of his report at the annual stockholders' meeting on Wednesday of this week. Any further taxation, Mr. Cortelyou said, would have to be added to the company's bills through an increase in rates, besides involving additional clerical and accounting expenses which would add to the expense of operation.

"The burden of taxation continues on an ever-ascending scale caused by the rapidly increasing expenditures of

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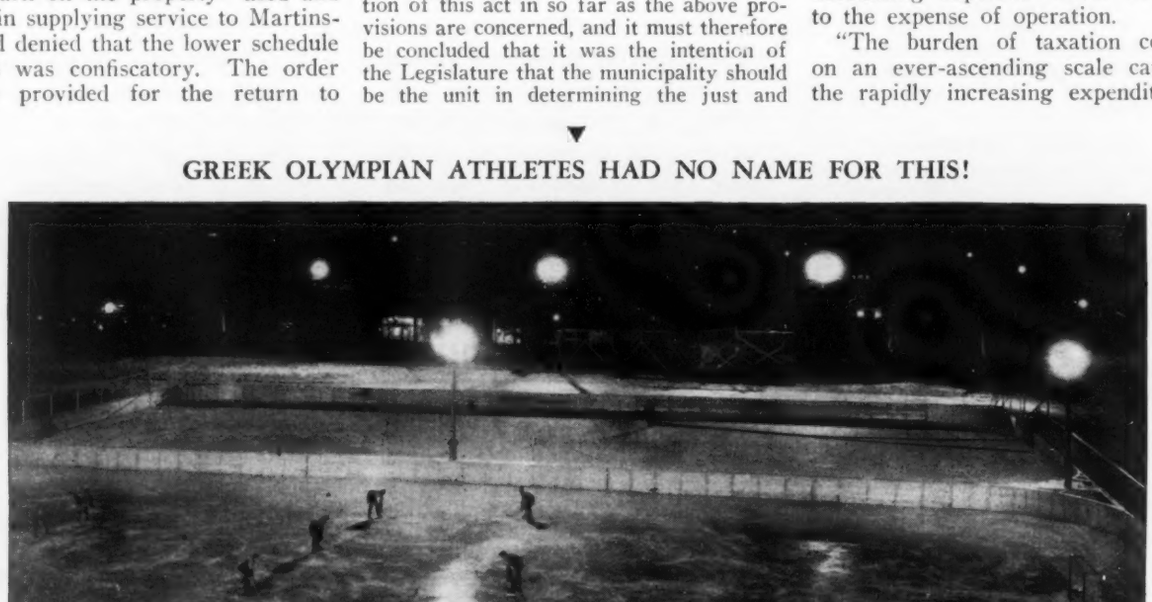
GREEK OLYMPIAN ATHLETES HAD NO NAME FOR THIS!



Beneath the rays of 29 General Electric floodlamps international hockey and skating matches went on this month at the Olympic Stadium at Lake Placid, N. Y., by night as by day. To illuminate the two hockey rinks and the ice-skating speed track, a total surface of 245 by 628 ft., 43 kw. is required.

federal, state and local governments," Mr. Cortelyou declared. "Nation-wide volume of business transactions has declined, while the oppressive burden of taxation has continued to increase."

The Consolidated Gas Company controls all the chief electric utilities in Greater New York, and Mr. Cortelyou said that the reduced amounts and new forms of electric rates which have been in effect a little more than six months for these utilities have sustained the expectation that they would reduce annual revenues more than $5,500,000 on the basis of the volume of sales in 1930.

▼

Associated Offers Big Issue of 8 per Cent "Baby Bonds"

The forty-million-dollar issue of guaranteed 8 per cent eight-year gold bonds offered to its security holders this week by the Associated Gas & Electric Company is unique in several respects. The yield establishes a precedent. The small denomination—units as small as $10 are offered—is a departure. The installment feature is unusual for this type of issue. Provision for the payment of additional interest of one-half of 1 per cent if stock dividends are paid is a feature. This issue, both in principal and in fixed interest, ranks ahead of all outstanding debt and other securities of the company.

Another feature of interest is that to each of the new bonds will be attached a stock-purchase warrant detachable after March 15, 1933, entitling the holder to purchase common stock of the company at stated prices.

The purpose of this issue is to retire $5,940,000 of bank loans, $3,100,000 of purchase money obligations and $26,163,000 of maturing obligations of subsidiaries. Aside from these, Vice-President H. C. Hopson says, "no obligations of any substantial amount fall due or are unprovided for prior to 1948. For financing these current obligations and maturities approximately twice as large an amount of mortgage bonds of operating companies is available, most of which are legal investments for savings banks and trust funds in the State of New York and in one or more New England states.

"Under the present conditions of high interest rates," Mr. Hopson continues, "your directors feel that the security holders of the company should have the first opportunity to subscribe for a short-term issue having an unusual rate of interest, excellent protection and a very attractive stock-purchase privilege. The success of this offering will make it unnecessary for the company to sell long-term mortgage bonds at present, enabling it to hold them until market conditions are more normal."

Utility Cuts Book Value of Investments Held

A leading utility has finally taken the step of writing down security values to a point more in keeping with market levels. The Electric Bond & Share Company shows assets as of December 31 amounting to $553,575,634 against $1,002,673,150 a year previous. Aggregate book value of investments as of December 31 has been written down from $904,093,646 to $462,705,922, almost a 50 per cent cut. In addition, the book value of miscellaneous marketable securities was reduced to approximately $36,431,000. These reductions have been charged against capital surplus, reducing that item to $248,002,852 from $708,619,491 at the end of 1930. A proposed reduction in capital of the company is discussed on page 387, this issue.

Net income of the company for 1931 totaled $25,050,084, equivalent after preferred dividends to $1.15 a share on 14,676,754 common shares outstanding at the year end. These results compare with net income of $42,355,163 or $2.42 on common stock for 1930. Gross revenues were $32,560,483 against $54,387,962, while expenses, including taxes, were $7,510,399 against $12,032,799. Surplus of income after dividends was $8,215,343 against $26,569,970. The preferred dividends were earned more than three times during 1931. The market value of the net assets of the company on December 31 was equivalent to approximately $207.40 a share on the preferred stocks and after deducting $1,000 a share on the preferred was equivalent to $10.65 a share on the common outstanding at the year end. The December 31, 1931, balance sheet shows current assets of $90,166,884 and liabilities of only $6,229,010.

▼

Subcommittee Appointed on Muscle Shoals Plan

Seven members of the House committee on military affairs have been appointed by Chairman McSwain of Greenville, N. C., to draft a bill providing for the disposition of the Muscle Shoals project. Mr. McSwain said the committee was instructed to draft the measure so as to provide for private leasing, if possible, with language that would place the project under the control and operation of the government as an alternative.

A third alternative is to be incorporated in the draft, he said, which will provide that if the government be made the operator of the project and at a later date a lessee be obtained, government operation will cease and the project go to the lessee.

Credit Structure Stronger, but Failures Increase

SLOWLY and painfully the credit structure of business and industry is apparently becoming stronger. Wholesale price liquidation, for the moment at least, appears to be checked and optimism is increasing steadily.

Basic business factors, however, offer little encouragement. Steel-mill activities continue to decline, although expectations of a belated seasonal rise in demand seem justified. A slow revival of buying interest on the part of the railroads is reported. Electric energy production dropped 8 per cent for the week ended February 20 against a 6.2 per cent drop the previous week.

The bank credit bill, designed to widen certain facilities of the Federal Reserve Banks, has been speeded to approval. While viewpoints on its probable effect differ widely, there seems general agreement that it will effect a definite betterment in banking conditions, very probably involving inflation.

Business failures increased sharply last week over the previous week. Dividend cuts and reductions have been unusually numerous in the past ten days and involve some leading corporations.

Utility Purchasing Policies Discussed

Good attendance characterized the meeting of the public utility group of the National Purchasing Agents' Association in Birmingham on February 18-20. Judge Samuel F. Hobbs of the Muscle Shoals Commission made an address in which he reported that Congress seemed favorably inclined toward the recommendations of the commission. He said that for fourteen years Muscle Shoals has been discussed chiefly with two theories in mind—first, its dedication to the fixation of nitrogen and, second, its use as a source of power distribution in competition with private utilities.

When the facts came in it was found that neither theory about Muscle Shoals had merit. Nitrogen, on a test run, cost 6 cents a pound. It could be produced now on a large scale for 4 cents, and yet it can be bought on the market for 2 cents. An equally absurd economic conclusion was reached by a study of power distribution within a 200-mile radius of Muscle Shoals. It would cost the government twice as much to build the transmission system as it did to build the power plant. It was found that if every possible load was served at present prices of utility service, the government would lose $1,475,000 each year. On the other hand, it is possible to develop the Tennessee Valley and

make fertilizer by the Swann process. Judge Hobbs estimated a saving in cost of fertilizer alone in the 200-mile area equal to its total present power bill.

Two other interesting addresses caused comment. Dr. George Lang discussed the "Psychology of Purchasing" and Dr. Janus S. Thomas defended the machine age.

Hugh White, president of the Alabama Public Service Commission, discussed purchasing and the public interest. Two broad conclusions of Mr. White are of interest. One is that as a result of loss of millions in utility securities and because utility executives act more and more as trustees of invested funds it is now necessary to regulate security issues of both holding and operating utilities. The other was contained in the comment that since utilities are limited to only a reasonable return in times of prosperity they could scarcely expect to earn an adequate return in a depression such as this one.

Other more definite topics presented and discussed concerned buying as affected by public relations, underwriters' laboratories, manufacturers' responsibility, safety, alloy steels and other things.

Very active discussion occurred on price buying, the distorted reputation of the purchasing agent, the giving of business to local industries and the principles and ethics of purchasing. T. R. Harber presided as chairman of the group meeting.

▼

Premier Henry Waxes Wroth Over Attacks on Hydro

Storm and stress over Hydro affairs continues unabated in the Ontario Parliament. At a recent sitting of the Legislature Premier Henry charged that Mitchell F. Hepburn, leader of the provincial Liberal party, had drawn his material for attacks against the Hydro-Electric Power Commission from a Chicago publication "directly built for the purpose of destroying public ownership." It was made evident that the Premier had in mind printed matter issued by the Utilities Publication Company of Chicago.

Mr. Henry backed his charges against Mr. Hepburn by producing a copy of the Chicago journal complained of and by reading from it certain excerpts which, he affirmed, tallied with public statements made by Mr. Hepburn. "An absolute falsehood from beginning to end" was Mr. Henry's term for the contents of the periodical, from its figures about the Chippawa development to its statements as to industrial expansion in Ontario under Hydro. Mr. Henry vigorously disputed the claim that Hydro had gone ahead more rapidly in Quebec under private ownership than in Ontario under public ownership. The increase in industrial expansion in Ontario, he said, was two and a half times more than in Quebec.

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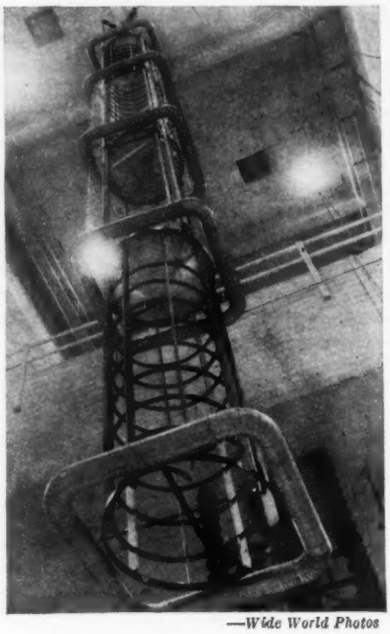
BUILDING SCIENCE'S TOOLS



—*Wide World Photos*

Serving the triple purposes of resistance unit, high-potential lead and "safety valve," this assemblage of glass and rubber tubes will carry a flow of water conveying 1,200 kv. constantly and twice that value temporarily, if desired, to the great X-ray tube now being finished at the California Institute of Technology laboratories from the design of C. C. Lauritsen.

▼

"Liberal" Utility Commissioners to Set up Forum

Announcement has been made through Morris Llewellyn Cooke, one of the trustees of the New York State Power Authority, that "a movement to provide an adequate forum for the exchange and dissemination of views on regulatory principles and practices throughout the United States will be launched in New York City on April 8 and 9."

The movement—sponsored, that announcement says, by twelve of the "leading exponents of public regulation in the country," denominated as "liberals—was accelerated in part by the action of those members of the National Association of Railroad and Utilities Commissioners who declared in a recent public statement their fear that "regulation in the several states is being seriously imperiled by the conduct of the affairs" of the national association. In that statement they further stated that the association "must change its course" or there will be no alternative except withdrawal from membership. (ELECTRICAL WORLD, February 6, page 252.)

Those signing this statement were the five members of the California Railroad Commission, headed by President C. L. Seavey; the three members of the Wisconsin Public Service Commission, headed by Chairman Theodore Kronshage, Jr., and Milo R. Maltbie, chairman of the New York Public Service Commission. All these are represented among the sponsors of the forthcoming conference, other sponsors being Henry C. Atwill, chairman of the Massachusetts Public Utilities Department; Harold Evans, former member of the Pennsylvania Public Service Commission; Felix Frankfurter, professor of law at Harvard; John H. Gray, past-president American Economic Association; Clyde L. King, Secretary of Revenue of Pennsylvania; Wiliam Z. Ripley, Harvard University; Frank P. Walsh, chairman of the New York Power Authority; George W. Woodruff, member of the Pennsylvania Public Service Commission, and Mr. Cooke, who is the former director of the "Giant Power Survey" of Pennsylvania.

An entirely new procedure for the conference has been adopted, the announcement says, in order to assure its effectiveness. Instead of a large convention gathering there will be round-table discussions limited to a small number of special groups interested in special phases of regulation of public utilities.

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Waukegan Fire Not Due to Circuit-Breaker Failure

Present evidence indicates that the fire which occurred Tuesday morning, February 16, at the Waukegan generating station of the Public Service Company of Northern Illinois was caused by the breaking down of a potential transformer in connection with the 132-kv. metal-clad outdoor switching equipment and not by a circuit-breaker failure, as was incorrectly reported on page 348 of the ELECTRICAL WORLD last week. The circuit breaker did not explode and was not involved in the accident. The equipment immediately cleared itself electrically, and there was no electrical failure other than that in the potential transformer.

There was no interruption to service on the interconnected system of the Public Service Company, of which this station forms a part, though one generating unit at the Waukegan station was taken out of service and other units were put on in order to isolate equipment adjacent to the trouble. A thorough investigation is under way to determine the exact cause of the accident.

Gov. Pinchot Makes Direct Attack on Duquesne Light

An attack upon the Duquesne Light Company of Pittsburgh for alleged overcharges to consumers of "about $15,000,000 during the last three years" was made by Governor Pinchot last week in a letter to western Pennsylvania municipal officials. The Governor urged the burgesses and mayors in Allegheny and Beaver Counties, to whom he addressed his charges, to demand "immediate relief" of the Public Service Commission, and threatened that he would cite "another large utility" on a similar charge unless it fulfilled a promise of lower rates.

Governor Pinchot expressed his hope based on recent developments that the Public Service Commission "can be forced to face the truth of utility overcharges," though he said it had had information as to such charges by the Duquesne Light Company before it for three years.

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St. Lawrence Conferences Being Held at Ottawa

Canadian interest in the St. Lawrence seaway and power development project is growing, according to Ottawa reports. Within six or seven weeks several meetings have taken place at Ottawa between representatives of the Dominion government, the Ontario government and the Ontario Hydro-Electric Power Commission regarding that part of the scheme from Prescott to the Quebec boundary.

Premier Taschereau of Quebec had written to Premier Bennett of the Dominion advising him that as soon as the session of the Quebec Legislature was over the provincial authorities would be ready to enter discussions relative to that part of the enterprise in which the Province of Quebec is concerned. In the meantime the Quebec government agreed to a request that it grant no hydro-power contract linked with the St. Lawrence within the limits of Quebec without the consent of the Legislature.

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Radio Interference Responsibility Shifted

Responsibility for radio interference is to a large measure placed upon the user of the receiving set by the provisions of a Los Angeles city ordinance made effective within the past month. It shall be unlawful, it is stipulated, for any person to operate any device which creates or causes high-frequency oscillations interfering with the reception of radio broadcast signals, provided that (1) the receiver interfered with is thoroughly and effectively shielded, (2) the antenna is 40 ft. or more in length and not less than 20 ft. above the ground, (3) the antenna lead-in is shielded, and (4) the field strength of the broadcast station interfered with is not less than 500 microvolts per meter of antenna length as measured by a field-strength meter.

The ordinance is enforceable by the police department with penalty for violation. This is thought to be the first step of such a character even taken—certainly as regards this country.

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Utility Bills Before New York Legislature

If a bill introduced in the Senate at Albany by Senator Thayer becomes law, the act relating to the powers and duties of the state commission appointed to make a survey of the interstate transmission of power will be amended by adding the exportation of gas to the field of investigation and by placing Canada and the Provinces of Quebec and Ontario in the same category as the states contiguous to New York. If corresponding commissions are appointed by any of these political entities, the New York commission is to negotiate with them; if not, then with the governors or premiers or the established utility commissions. By the terms of Senator Thayer's bill the lifetime of the commission is extended until 1933 and $25,000 appropriated to its use.

A bill introduced in the Lower House by Assemblyman Doyle forbids any electric or gas utility to make a minimum rate charge of more than 50 cents.

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Lilienthal Gives Views on Commission Functions

How public utility companies should be regulated in the view of members of the reorganized Public Service Commission of Wisconsin was expressed in a recent radio address by one of its members, David E. Lilienthal, who said:

I conceive of public utility regulation not as a job for judges, but as an administrative task. It seems to me that it is the duty of a commissioner not merely to sit back and listen to complaints, but to keep an active, supervising eye on the operations of the public utilities under his jurisdiction.

When a commission finds from the filed reports and from other sources of information submitted to it that it is likely a public utility is charging an unreasonably high rate, it should, on its own motion, order its staff to see that the facts are produced with respect to that company. On the other hand, if it finds that a utility is being unjustly treated in rates, then it should, regardless of public demand, decide that case on its facts and order rates increased. In other words, I conceive of the Public Service Commission as an aggressive, fact-finding body.

Mr. Lilienthal also expressed the belief that the commission's conception of the public interest in utility regulation "must be comprehensive enough to include not only the public interest in your protection as consumers, but the public interest in the protection of the investor as well." He continued:

These great and essential industries must above all other industries be stable and secure. Regulation of the kind we are trying to put into effect will, we believe, not only protect your interest as consumers, but, by eliminating the possibility of speculative excessive profits, will keep speculators out of this business and in other ways tend toward the stability of the public utility industry.

Coming Meetings

Oklahoma Utilities Association—Tulsa, Okla., March 8 and 9. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Pacific Coast Electrical Association—Engineering and Purchasing and Stores Sections, Fresno, Calif., March 9-11; Commercial Section, Santa Cruz, Calif., March 17 and 18. K. I. Dazey, 447 Sutter St., San Francisco.

American Institute of Electrical Engineers—District meeting, New Pfister Hotel, Milwaukee, March 14-16; Providence, May 4-7. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—Group committee meetings, Commercial National Section, Edgewater Beach Hotel, Chicago, March 22-24. A. J. Marshall, 420 Lexington Ave., New York.

Maryland Utilities Association—Lord Baltimore Hotel, Baltimore, April 8. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

New England Division, N.E.L.A.—Engineering Section, Boston, March 3 and 4; safety conference, Boston, April 8. Miss O. A. Bursiel, 20 Providence St., Boston.

Great Lakes Division, N.E.L.A.—Engineering Section, Sherman Hotel, Chicago, April 13 and 14. R. J. Malcomson, 72 W. Adams St., Chicago.

Northwest Electric Light and Power Association—Engineering Section, Heathman Hotel, Portland, April 13-15; H. H. Schoolfield, Pacific Power & Light Company, Portland. Accounting Section, Davenport Hotel, Spokane, Wash., April 18-19; W. F. Miller, Washington Water Power Company, Spokane.

Arizona Utilities Association—Tucson, Ariz., April 13-15. J. S. Arnold, Central Arizona Light & Power Co., Phoenix, Ariz.

Electrochemical Society—Lord Baltimore Hotel, Baltimore, April 21-23. C. G. Fink, Columbia University, New York.

Southwestern Division, N.E.L.A.—Arlington Hotel, Hot Springs, Ark., April 25-28. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 28-30. Jesse Blythe, 103 West High St., Jefferson City, Mo.

Middle West Division, N.E.L.A.—Muehlbach Hotel, Kansas City, Mo., May 18-20. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

East Central Division, N.E.L.A.—Commodore Perry Hotel, Toledo, Ohio, May 24-27. D. L. Gaskill, 603 Broadway, Greenville, Ohio.

National Electric Light Association—Atlantic City, N. J., June 6-10. A. J. Marshall, 420 Lexington Ave., New York.

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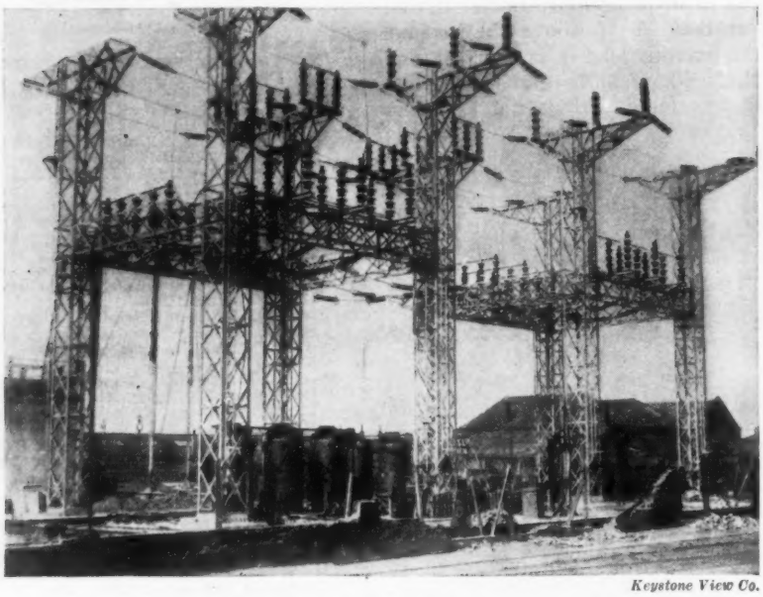
A CONSTRUCTION ITEM IN THE NEW BRITISH "GRID"



Keystone View Co.

At Yarmouth, England, where 132-kv. cables cross the River Yare at the famous Fish Wharf, this transformer station has been built as part of the electrical undertaking which is setting a new tempo for Great Britain.

Electricity in Britain Advanced Far in 1931

Grid may be finished in 1932—Condensers on turbine floor—Another 36,000-volt alternator, 132,000/400-volt transformers.

Rapid progress for the British electricity supply industry was registered in 1931, bringing the construction of the Central Electricity Board's national scheme so far ahead of schedule that there is every likelihood that the project will be realized in its entirety either at the end of 1932 or early in 1933. All the large district contracts, totaling about $110,000,000, have now been placed.

The areas in which progress was greatest were mideast, northeast, central and east England. In those districts and in central Scotland construction is either finished or in sight of completion. About one-half the required mileage of secondary lines has been constructed.

All rights-of-way for primary transmission lines are complete in central Scotland, central, northwest, northeast, mideast and east England, while in southeast England and south Scotland completion was expected by the end of February. Only one area, southwest England, now remains for attention. Secondary transmission lines for central Scotland, central, mideast, northeast and east England are complete, while negotiations are nearly complete in northeast England, leaving only southeast and southwest England and south Scotland to be developed.

Standardization of frequency was extremely rapid in central Scotland and northeast England. Electrification of textile mills made substantial progress.

The largest turbo-generators yet ordered in Britain are the two rated at 75,000 kw. being built for the Barking extension of the County of London Electricity Supply Company's station. Two other interesting sets in process of erection—one almost finished—are 67,200-kw. units for the London Power Company's Battersea station. All four turbines are of the three-cylinder type. Those at Barking are designed for steam at 600 lb. and 800 deg. F., those at Barking for 570 lb. and 850 deg. F. The three 50,000-kw. sets under construction for the Dunston station of the Newcastle-on-Tyne Electric Supply Company are designed for interstage resuperheating of the steam. Steam at 600 lb. and 800 deg. F. will be expanded down to 120 lb. pressure in the high-pressure cylinder and returned to the boiler house for resuperheating to the initial temperature of 800 deg. F. It is then expanded in a single-flow low-pressure cylinder to 29-in. vacuum. These turbines were made by C. A. Parsons & Company, who have been responsible for the development of the geared "Uniplane" type of turbo-alternator, which requires no basement as the condensers are placed alongside the turbine. The circulating-water pump may be driven either from the extended exciter armature shaft or, like the extraction pump, by gearing from the pinion shaft in the gear case.

A special transformer chamber built on the foundation block is a feature of the two 71,500-kva. turbo-generator sets installed at the Clarence Dock station in Liverpool. This arrangement gives compactness to the design of the station, eliminates the need for a separate transformer house and shortens the heavy cables between the generator and transformer.

Following nearly four years' commercial operation of the first Parsons high-voltage set a second 25,000-kw. alternator, generating directly at 36,000 volts, is now being erected in the North Metropolitan Power Company's Brimsdown station. This alternator is coupled to a 3,000-r.p.m. reaction-type turbine with two cylinders arranged in tandem, coupled to a double-exhaust, single-shell condenser of the inverted type.

An interesting development is the use of small power transformers directly connected to the 132-kv. "grid" transmission lines (i.e., without any intervening switchgear or fuses). The Central Board has ordered two three-phase banks for the above service, each bank being rated at 50 kva., 132,000/400 volts.

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Tide Water Company Quiz Shows Both Profit and Loss

More testimony regarding the Tide Water Power Company was taken on February 17 and 18 in the course of the Federal Trade Commission's investigation into operating-company and holding-company units under Middle West Utilities and Insull control (ELECTRICAL WORLD, Februray 20, page 340). The somewhat complicated financial history of the North Carolina utility was gone into at further length.

Examiner Hughes said that when in 1928 Tide Water was taken over by the Seaboard Public Service Company, one of the National Electric Power's subholding concerns, Tide Water in transferring its common stock made a profit of $951,080. Because, however, of the loss of revenues previously received from the Florida Power Corporation but transferred to the Seaboard company, Tide Water's income became insufficient to meet its preferred-stock dividends and pay interest on outstanding bonds. The company thereupon called all its outstanding bonds and preferred stock for redemption, replacing them with new securities. After several other exchange transactions, the book value of outstanding stock shrank to $2,865,650 as compared with the original $7,352,050.

After the presentation of much more data by Trade Commission men covering the financial and business management of the company hearings were adjourned, the commission announcing that Florida Power Corporation affairs would be taken up on February 24.

Problem Is Seen in Defining the Basis of Tax on Energy

WHILE the form which the proposed 7 per cent federal tax on domestic consumption of electricity may finally take is still indefinite, much speculation exists with regard to its applicability and probable incidence. Pending specific information it is assumed that the tax will be levied directly upon the consumer. It is expected to yield about $50,000,000, according to preliminary estimates. The electrical industry already carries a tax load estimated at $216,000,000 levied directly on the producing companies.

One feature to which observers attach importance is whether or not the bill will be so framed as to include customers of municipal plants. If it is not so worded as to cover the output of these plants, which collectively account for nearly 10 per cent of the domestic total, the result will involve unfair discrimination against private plants obliged to compete with untaxed municipal plants.

In the application of the proposed 7 per cent tax it is pointed out by some of those interested that some difficulty—perhaps much difficulty—may be met in defining domestic service. The border line between domestic and commercial service, for example, is extremely narrow. Some rate structures do not classify domestic and small commercial service separately, simply calling for a given rate per kilowatt-hour for small users, perhaps with one or more steps as consumption increases.

There are doubtless many cases where a small store or business is on the same meter with the owner's place of residence, if the two are in the same building. Disputes would inevitably arise, it is pointed out, regardless of the classification used on the books.

Another source of possible difficulty arises out of submetering. In large cities, notably New York, many families in apartments buy energy from the submetering company or landlord. The building is served at wholesale. It is not a "residential customer." Landlords and submetering companies are under no utility jurisdiction requiring reports. Hence the tenants would not pay the proposed tax through any utility company. In still other cases electricity is included in the rent. Except through inquisitorial methods and costly administration, these customers—or many of them—would be exempt. A tax that is discriminatory is not a fair tax.

As a consumption tax purely, the incidence of the proposed impost is clearly defined. The total tax, as preliminary announcements are interpreted, will be added to the consumer's bill. To the average domestic bill, which is about $34 a year, would be added $2.38 a year, or 20 cents a month. It is thought that such an addition would inevitably result in economies on the part of the consumer which would eventually tend to lower the gross revenue. In this way part of the effect of the tax would fall upon the companies providing the service. It is not inconceivable that such a tax imposed directly upon the consumer would lead to agitation for rate reductions in certain localities. A public relations problem might thus be involved, although superficially no question of company-consumer relations would seem to enter the problem.

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Bond & Share Plans Cut in Outstanding Shares

The proposal by the Electric Bond & Share Company to recapitalize with one-third the number of common shares now outstanding represents a policy which many industrial concerns have already adopted. "Reverse splits" is the name used in the street for the process. It is obviously the reverse of the boom-day practice of splitting one high-priced share of stock into several new shares. While the policy has been rare in the utility field, it has been rumored, without official confirmation, that the Commonwealth & Southern Corporation may take similar action.

One factor in these recapitalization plans is the greater advantage which a higher-priced stock has as collateral for bank loans. A stock selling as low as $10 a share or under is less valuable as a borrowing medium. Furthermore, in building up a permanent list of investor stockholders it has been thought that a stock selling around $50 or over offers the most desirable medium.

The Electric Bond & Share Company, incorporated in New York State, operates under statutes which contain a provision that no corporation shall declare or pay any dividend unless the value of its assets remaining after the payment of such dividend shall be at least equal to its capital and other liabilities. This applies whether or not dividends are currently earned. This statute does not prescribe any method to be used in determining the value of assets. While current earnings of the company are ample to take care of the usual dividends on both preferred and common stock, it may not be considered wise in view of the above statutes to declare or pay dividends at a time when market fluctuations might temporarily impair the existing small excess of value of assets over capital and other liabilities. According to officials of the company the proposed changes would remove all question as to the legal propriety of paying dividends currently earned.

Directors will call a special meeting of stockholders for March 22 to act on the proposed change, which would give the common stock a par value of $5.

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Stock Averages Down Fractionally

The minor market movements of the week have not changed utility common stock levels materially. Averages are down only fractionally from a week ago and continue close to the average, which has become more or less stabilized at a level over the past two months.

Smaller December Earnings for Light and Power

EARNINGS of central-station electric light and power companies in December exceeded those of November by $4,400,000, but were less than in the corresponding month a year ago by nearly $7,000,000, or 3.6 per cent. For the fifth consecutive time the monthly revenue has fallen short of the amount in 1930, though never by more than a few per cent.

The decline affected all parts of the country, but was heaviest in the East North Central and West South Central States, with 7.2 and 5.4 per cent respectively. It was small in New England and in the South Atlantic States.

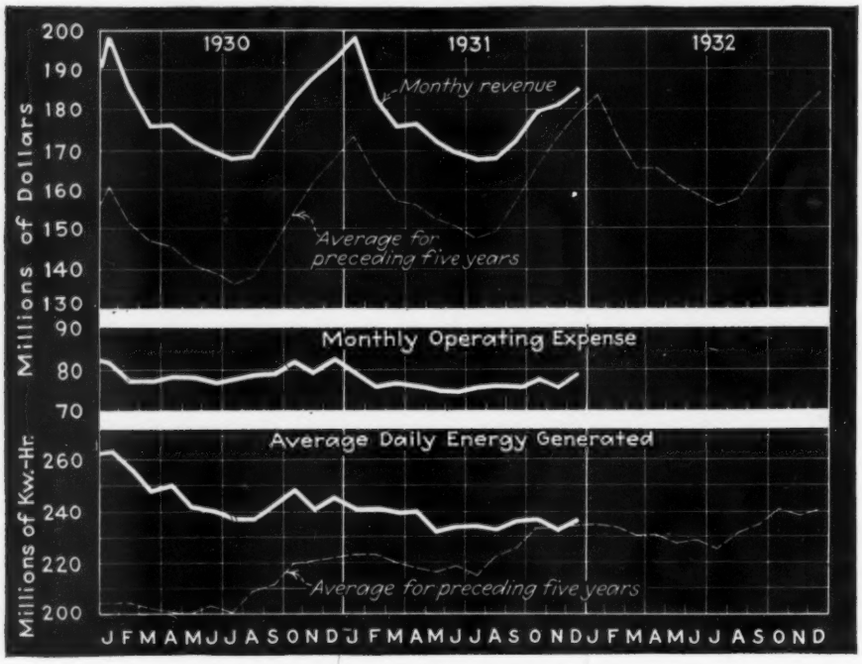
1930
1931
1932
Monthly revenue
Average for preceding five years
Millions of Dollars
Monthly Operating Expense
Average Daily Energy Generated
Millions of Kw.-Hr.
Average for preceding five years
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

Table I—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1931	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
September	7,087,057	—3.1	2,006,645	—2.5	5,080,412	—3.3	1,963,000	—0.2
October	7,346,956	—4.7	1,913,798	—8.4	5,433,158	—3.4	2,040,000	+0.7
November	6,994,826	—3.2	1,963,518	—2.3	5,031,308	—3.6	1,951,000	—1.6
December	7,357,865	—3.3	2,568,786	+17.5	4,789,079	—11.6	1,957,000	.....

Table II—Regional Operations, Revenue and Energy Output in December, 1931

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	185,050	—3.6	7,357,865	— 3.3	2,568,786	+17.5	4,789,079	—11.6
New England	19,870	—1.2	500,627	— 6.6	228,222	+40.7	272,405	—27.1
Middle Atlantic	49,910	—2.6	1,911,209	— 3.3	505,890	+43.1	1,405,319	—13.3
East North Central	43,640	—7.2	1,750,578	— 5.6	212,526	+71.2	1,538,052	—11.1
West North Central	15,490	—4.0	518,111	+ 4.9	170,070	+85.5	348,031	—13.4
South Atlantic	19,140	—1.0	819,138	— 2.7	402,608	+11.8	416,530	—13.4
East South Central	6,200	—3.8	304,319	+ 0.6	243,245	+ 5.6	61,074	—15.2
West South Central	10,350	—5.4	356,474	— 8.5	3,865	—51.9	352,609	— 7.6
Mountain	4,420	—3.2	222,959	—13.6	154,171	—21.1	68,788	+10.0
Pacific	16,030	—2.5	974,450	+ 2.2	648,179	— 1.8	326,271	+11.1

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central-station operations.

The regional changes resemble those of November, published in the issue of January 23.

For a time vigorous growth in the domestic business more than balanced the shrinkage of revenue for industrial power. Latterly the domestic energy sales have been expanding much more slowly; meanwhile, industrial consumption is still falling off. A moderate decrease in revenue is thus easily explained.

Operating and maintenance expenses, exclusive of such items as taxes and amortization, also decreased—from $81,890,000 a year ago to $79,850,000. The change amounts to 2.5 per cent, and is relatively smaller than in the preceding four months. Indeed, its smallness is worth noting. Most of the decrease can probably be accounted for by lower cost of fuel, as a result both of declining unit prices and of a lessened output of steam-generated energy. The inference follows there has been no skimping as to employment, that physical plant has been kept up to standard and personnel held together.

Energy output, 7,357,865,000 kw.-hr. according to data collected by the Geological Survey, is down 3.3 per cent compared with what it was a year ago, but shows a slight rise in average daily output from November, as was to be expected. More abundant stream flow made possible an increase of 17.5 per cent in the hydro-electric energy, compared with December, 1930, and a diminution of 11.6 per cent in the output from fuel, to which reference has already been made.

Hydro-electric output was notably larger in the northeastern and north central groups of states, as will be seen in the table showing regional operations.

Table III—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

Month	Total Gross Revenue from Sale of Energy*		Total Operating and Maintenance Expense†	
	1931 Thousands	Per Cent Inc.	1931 Thousands	Per Cent Inc.
Sept.	$171,930	—1.7	$75,300	—4.4
Oct.	178,630	—2.4	77,050	—5.6
Nov.	180,610	—3.6	75,270	—4.5
Dec.	185,050	—3.6	79,850	—2.5

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.

†Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions.

Kansas Power & Light Bonds Listed

First and refunding mortgage, series C, 6 per cent bonds of the Kansas Power & Light Company, amounting to $7,500,000, have been admitted to listing on the Chicago Stock Exchange on a when-issued basis.

Refrigeration Sales Gain Impetus

Twenty million dollars' worth of electric refrigerators were sold in New England in the year 1931, and the outlook is good for an equal or better showing in 1932," declared President W. C. Bell of the New England division of the National Electric Light Association at a recent joint meeting in Boston of the Commercial and Public Relations Sections of that body. "Connecticut exceeded its quota by 15 per cent and Vermont by 7 per cent last year. In the whole country about 950,000 machines were sold, valued at about $230,000,000 and yielding a repeated annual income of about $2,500,000 from the use of energy. Such success would have been impossible without co-operation in the industry and local trade. On devices selling for $100 or over local co-operation is vitally important, essential as it is in lower-priced products. Sales this year will require still harder work, requiring better planning and more vigorous effort. Prosperity is stimulated all along the line in industry and business by the manufacture and sale of nearly $300,000,000 worth of a product like this."

George Brown, manager N.E.L.A. Refrigeration Bureau, New York, pictured the promising outlook for this year's sales. Only 17 per cent of the existing 20,500,000 wired homes of the country have electric refrigerators. More than 65 per cent of the units were sold on a house-to-house basis. About 3,500,000 units are now in service, each averaging to yield $27.50 per year in central-station revenue at a 5-cent rate on 550 kw.-hr. per year. A recent survey reveals the following number of refrigerator sales per 1,000 families in the stated income ranges: Under $2,000 per year, 55; $2,000 to $3,000, 123; $3,000 to $5,000, 187; $5,000 to $10,000, 236, and over $10,000, 302. In May it is estimated that 20 per cent of the year's quota will be sold, and in New England, with 86 refrigeration bureaus functioning and 1,866,340 domestic meters in use (as of last June), this year's quota is 93,217 units.

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Coast Unit Sells Customers Million Preferred per Week

Announcement is made by the Pacific Gas & Electric Company that over-the-counter sales of its first preferred 6 per cent stock are proceeding at the rate of substantially $1,000,000 per week. Total sales from January 28 to and including February 16 amounted to $2,312,775. The total number of subscriptions was 3,100, received from all sections of the company's territory, and averaged $746 per purchaser. This indicates intensive distribution and a substantial accession to the company's already large list of local stockholders. About three-fourths of the stock is being paid for in full and about one-fourth is being bought on the installment basis. Since inaugurating customer ownership, in 1914, the company has sold a total of $73,289,000 of its preferred stock over its own counters.

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Indiana Merger Completed

Articles to complete the merger of the Indiana Electric Corporation with the Public Service Company of Indiana have been filed with the Secretary of State in Indianapolis. Officials of the Public Service Company said they will operate all plants and property of both corporations and that the merger will simplify the management and operation of the properties. The merger was authorized by the commission last December. By terms of the order, agreed on by the two companies, each holder of one share of preferred stock of the Indiana Electric Corporation is to receive 1.85401 shares of the common stock of the Public Service Company. Each holder of one share of the common stock of the Indiana Electric will receive 1.88877 shares of the Public Service Company common stock.

Utility Companies Reduce Dividends

Directors of the Engineers Public Service Company declared a dividend of 35 cents per share on the common stock, payable April 1 to holders of record March 17. Distributions of 40 cents each were made on this issue on January 2 last and on October 1, 1931, and one of 50 cents per share on July 1, 1931.

The Laclede Gas Light Company has declared a quarterly dividend of 1½ per cent on the common stock, par $100, payable March 15 to holders of record March 1. During the years 1928, 1929 and 1930 the company made quarterly distributions of 2½ per cent on this issue, while during 1931 four quarterly dividends of 2 per cent were paid.

Directors of the Central Public Service Corporation have voted to omit the quarterly dividend ordinarily payable March 15 on the class A stock, no par value. In each of the two preceding quarters a distribution of 1¼ per cent in stock was made on this issue, as against 2½ per cent in stock previously.

Directors of the United Corporation declared a dividend of 10 cents a share on the common stock, against 18¾ cents previously paid quarterly. This places the stock on a 40-cent annual dividend basis as compared with 75 cents formerly paid.

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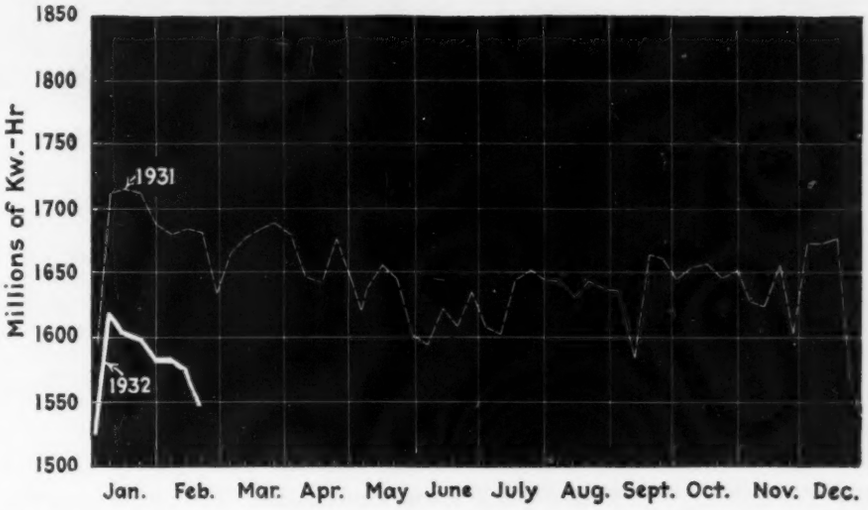
Output Declines, Especially in Mid-West



WHETHER as an after effect of the preceding holiday or because it included a week-end followed by a holiday, or for some more obscure reason, electric energy output during the week ended February 20 was 8 per cent less than in the corresponding period of 1931. The decline is unusually large, exceeding the 6.2 per cent of the week before and the 6.7 per cent early in January.

Weekly Output, Millions of Kw.-Hr.

	1932	1931	1930	1929
February 20	1,545	1,680	1,746	1,699
February 13	1,579	1,684	1,770	1,718
February 6	1,589	1,679	1,782	1,726
January 30	1,589	1,687	1,809	1,728
January 23	1,598	1,713	1,826	1,717

Per Cent Change from 1931

Region	Week Ended Feb. 20	Feb. 13	Feb. 6
Atlantic seaboard	— 4.8	—3.6	—1.1
New England alone	— 4.6	—4.2	—2.3
Central industrial	—12.2	—9.7	—7.8
Chicago district	— 7.5	—8.5	—3.5
Pacific coast	— 5.1	—2.4	—5.5

General Electric Forms Distribution Department

A distribution department has recently been added to the commercial department of the General Electric Company to take charge of the finished stock of all products exclusive of those of the incandescent lamp, electric refrigeration, merchandise and plastics departments. This new division will be headed by J. V. Anthony, formerly connected with the San Francisco office, as manager, and Hancock Griffin, former supervisor of district stocks and warehouses, as assistant manager.

In addition to the handling, warehousing, shipping and billing of finished stocks, both at the various works and at the sales warehouses, the distribution department also has the function of studying methods and inaugurating changes in procedure for the purpose of providing the best possible service at minimum expense.

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Interim Rates Ordered for San Diego Utility

An order has been issued by the California Railroad Commission setting up interim rates for electric, gas and steam service for the San Diego Consolidated Gas & Electric Company to obtain while a permanent rate base is being sought. The commission estimates that the new schedule will reduce the company's gross revenues by $600,000 annually and should decrease net profits by $475,000, thus giving it net earnings of about 8½ per cent.

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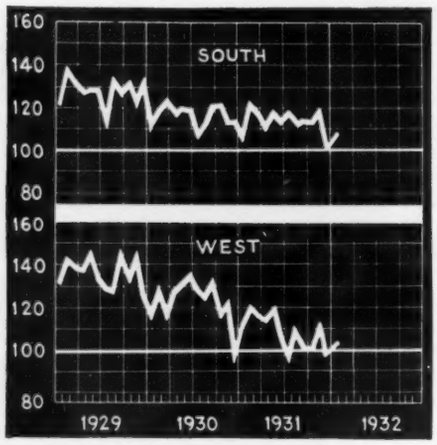
Southern Industry Picks Up

INDUSTRIAL activity in the South registered an increase in January compared with the corresponding month of 1931. The region thus stands out in contrast to the other four of the five industrial divisions into which the country is divided for the purposes of this survey. The index numbers here given for two of them supplement those for the other three and for the country as a whole published in last week's issue.

The relative gain over 1931 in the average for the South is due largely to a 28 per cent improvement in textiles, a 9 per cent advance in the food industry, one of 8 per cent in wood products, and one of 5 per cent in the stone, clay and glass group. But the metal industries remain low, although activity in iron and steel mills was materially greater than in December.

In the West there is some evidence of an upward turn. In recent years the January index has been decidedly below that of the preceding summer and autumn; this year it is above the average for the preceding half year. Also, although the index is lower than it was a year ago, it is gradually approaching those earlier figures. In January the difference was 6.4 per cent. Not long ago differences as great as 25 per cent were recorded.



Figures for the individual industry groups indicate that normal or nearly normal consumption is going on in those lines that supply the ordinary needs of the population, but that in common with the rest of the country the West has little demand for products used primarily in industrial expansion.

Indices of Industrial Activity in South and West

Base: Average Month, 1923-1925 = 100

Industrial Groups	South					West				
	January, 1932	December, 1931	November, 1931	October, 1931	January, 1931	January, 1932	December, 1931	November, 1931	October, 1931	January, 1931
All Industry	**108.1**	**106.0**	**119.3**	**113.2**	**105.8**	**104.0**	**98.3**	**110.9**	**102.2**	**111.0**
Chemicals	136.2	137.0	160.0	144.6	146.4	92.0	88.3	98.9	88.0	*82.4
Food	163.0	151.9	174.8	148.8	149.0	129.0	134.4	149.0	131.8	126.0
Iron and steel	145.2	117.0	120.3	160.2	207.0	.....	.....	.....	.....	.....
Metal-working plants	64.1	68.5	79.0	76.6	95.4	.....	.....	.....	.....	.....
Metals group	109.5	104.3	104.8	122.2	157.3	45.3	32.7	46.9	42.5	71.6
Forest products	59.8	44.6	60.7	55.7	55.4	136.0	124.8	135.5	128.1	136.9
Paper and pulp	124.8	96.6	124.4	133.8	143.8	121.0	110.6	122.2	114.3	126.0
Rubber	96.7	65.2	79.5	73.8	87.5	103.7	53.7	68.1	107.4	157.0
Shipbuilding	.....	.....	.....	.....	.....	96.7	87.8	98.1	88.1	112.9
Stone, clay and glass	106.7	113.1	199.0	154.9	101.1	83.5	79.9	112.3	87.3	93.8
Textiles	97.4	102.8	106.1	111.7	75.8	.....	.....	.....	.....	.....

Red Cedar Pole Dimension Table

When the American Standards Association established a table of standard dimensions for Western red cedar poles for 1931, based on the standard modulus of rupture of 600 lb. per square inch, it also established a similar table for Northern white cedar, one for chestnut and one for creosoted Southern pine, each based on a standard modulus of rupture. These four standard dimension tables were built on the same basic principles which resulted in a high degree of uniformity throughout the four tables, such as the same pole length, the same number of classes, the same top circumferences, the same ground line distances from the butt, the same 6 ft. from butt point for designating butt circumferences and the same class of breaking loads. The only variation that occurs in these four tables is in the minimum circumference, 6 ft. from the butt.

The feature of these four tables is that for any given class and length all four species are equal in strength. For example, a 40-ft. class 2 Western red cedar pole has the same strength as a 40-ft. class 2 chestnut Northern white cedar or creosoted Southern pine pole. The basic principles upon which these tables are constructed conform to and are consistent with the accepted engineering practice of the larger transmission and communication utilities.

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Lamp Socket Standard Approved

An American standard for rolled threads for screw shells of electric sockets and lamp bases (C44-1931) has been approved by the American Standards Association. The standard covers the dimensions, tolerances and gages for rolled threads of Edison-type screw shells intended for use in the manufacture of lamp bases and plugs and of lamp and fuse holders. The dimensions concerned are given for five sizes, miniature, candelabra, intermediate, medium and mogul.

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Tampa Electric Increases Dividend

At a meeting of the board of directors of the Tampa Electric Company a quarterly cash dividend of 56 cents per share was declared on the common stock. Heretofore the common dividend rate has been 50 cents quarterly in cash and 2 per cent semi-annually in stock. At the same time the regular quarterly dividend of $1.75 per share on the preferred stock was declared. Both dividends became payable February 15 to stockholders of record at the close of business January 25.

Natural Ice Shortage May Boost Refrigeration

Electric refrigeration may easily receive a boost as a result of the shortage of natural ice throughout the country, according to G. W. Mason, president of the Kelvinator Corporation. Mr. Mason points out that the country is faced with a natural ice shortage owing to the mildness of the winter, which has had no equal since the mild winter of 1890.

Notwithstanding the availability of electric refrigeration today there are still many rural communities all over the country which must depend on natural ice cut in the winter time and stored for their use later. Thousands of cottagers and campers in rural districts still place their dependence on natural ice. Manufactured ice is not available to many of these. "The logical solution of the problem for those who have depended on natural ice," Mr. Mason states, "will be the adoption of electric refrigeration. Electric power is available in about every rural community now, and even the suburban cottages have it."

Major New Construction This Week

EXTENSIONS in the underground conduit system at Akron, Ohio, to cost $55,000 will be made by the Ohio Edison Company. Purchase of electric meters to an amount of $75,000 is also authorized, as well as street-lighting extensions to cost $45,000.

Electric-operated refrigerating and cold storage equipment, motors, controls and panels, electric-driven conveying and loading machinery and power substation equipment costing close to $100,000 will be installed in the produce terminal of the Southern Pacific Lines at New Orleans, La., plans to ae completed early in April. Entire cost about $1,000,000.

Transformers and other station equipment will be installed at the power plant of the Public Service Company of Northern Illinois, Waukegan, to replace the loss caused by fire recently. Estimated cost of equipment over $100,000.

Bids are being asked until March 8 by Grand Junction, Iowa, for complete electrical machinery for a municipal power plant, including Diesel engine-generator unit and accessories. A fund of $85,000 is available.

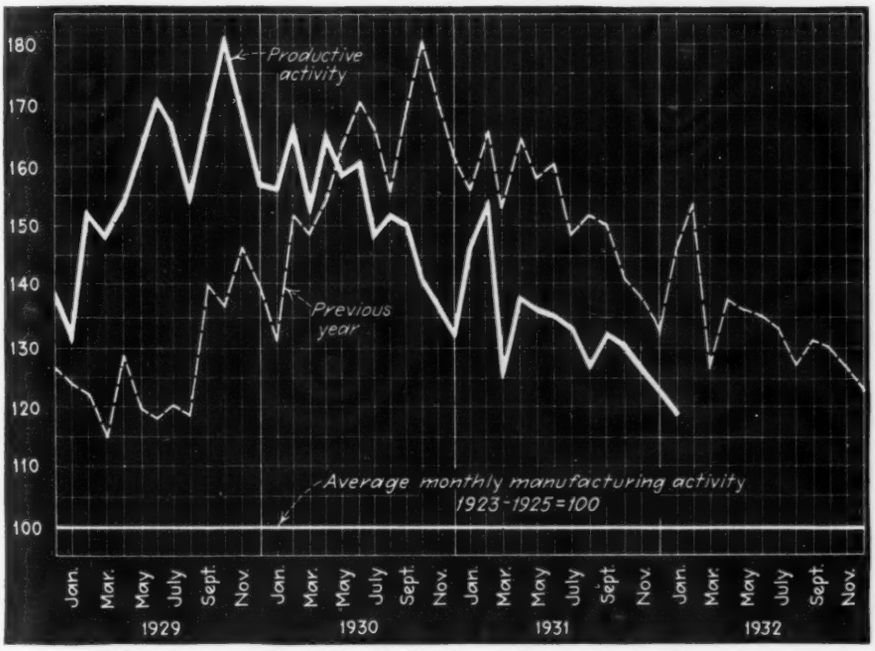
Forty-thousand dollars will be expended at once by the Public Service Electric & Gas Company, Newark, N. J., for extensions and improvements in street-lighting system at Orange, N. J., including lighting units and equipment.

Heavy-duty motors and controls, panelboards, electric tools and other electric power equipment will be installed in the car and locomotive shops of the White Pass & Yukon Railway Company, Skagway, Alaska, to replace a recent fire loss totaling over $250,000, more than one-half representing equipment.

Bids are scheduled to be asked early in April by Versailles, Ky., for electric driven centrifugal pumps, motors, automatic controls and accessories for water system service. A fund of about $50,000 is being arranged for the program.

Electric-operated refrigerating machinery, heavy-duty motors, panelboards, controls, conveying and loading equipment to cost close to $60,000 will be installed in the $200,000 fruit-packing plant to be constructed by the Bitter Root Packing Corporation, Hamilton, Mont.

Electrical Manufacturing Slower



RETURNS of energy consumption in electrical manufacturing indicate a further decline of activity in that branch of industry. The decrease is not large; the January index misses the December by only 3 per cent, and the decline in other recent months has been no greater; persistence rather than magnitude has characterized the downward movement. Total operations in January were about equal to those in November, but the latter was a shorter month with, therefore, a higher average rate. No pronounced movements are apparent either as to type of product or geographically.

Comparison with January, 1931, is liable to mislead because there was a temporary rise early last year that soon died out. A more instructive comparison can be made if operations in electrical manufacturing are contrasted with those in the related metal-working industry as a whole.

The high point in electrical manufacturing, according to the ELECTRICAL WORLD index, came in October, 1929; the index was 180.6. The present January index is 119.0. The decline therefore was 34 per cent. That is to say, after two years of generally decreasing activity the industry is still operating at 66 per cent of the peak rate.

In the metal-working industry the maximum index was 153.7, reached in February, 1929. The index for January was 72.7. That is 47 per cent of the peak rate. Thus the decline in electrical manufacturing has been considerably less severe than in the whole metal working group.

Monthly Index of Electrical Manufacturing Activity

Adjusted to 26 working days
Base: Average Month, 1923-1925

Month	1929	1930	1931	1932
January	131.3	156.2	146.6	119.0
February	151.8	165.2	154.3	.....
March	148.3	153.0	126.1	.....
April	154.6	164.9	138.1	.....
May	163.5	158.0	136.7	.....
June	170.5	160.2	135.2	.....
July	166.6	148.5	133.4	.....
August	155.4	152.2	126.9	.....
September	168.8	150.0	132.6	.....
October	180.6	140.6	130.4	.....
November	169.5	137.5	126.9	.....
December	157.0	132.4	123.5	.....

New York Metal Prices

	Feb. 17, 1932 Cents per Pound	Feb. 24, 1932 Cents per Pound
Copper, electrolytic	6.25	6.25
Lead, Am. S. & R. price	3.75	3.75
Antimony	6¾	6¾
Nickel, ingot	35.00	35.00
Zinc, spots	3.175	3.175
Tin, Straits	22.25	22.20
Aluminum, 99 per cent.	23.30	23.30

St. Paul Utility Gets Year's Permit

Unanimous approval by the St. Paul City Council of three ordinances granting the Northern States Power Company the right to operate in the city during the forthcoming year without franchises and with no change in rates, the company continuing to pay a 5 per cent gross-earnings tax, has been extended. As reported on January 16 (page 119), St. Paul voters refused to approve 20-year franchises for the company without the tax. Corporation Counsel L. L. Anderson urges that the Council and the Northern States Power Company agree on a reasonable valuation of the company's property, set up a depreciation reserve and then make rates adjustable yearly on a basis of a fair return on the valuation, with a fair allowance for depreciation.

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Denver's New Electric Rates

Revised electric rates in Denver, Colo., referred to last week and effective with March 15 meter readings, make the domestic charge 6 cents a kilowatt-hour for the first 40 kw.-hr. and 5 cents on all additional, as compared with the former 7-cent rate for the first 15 kw.-hr., 6 cents for the next 30 and 5 cents for any excess. The new commercial lighting schedule is 5 cents for the first 1,000 kw.-hr., instead of the previous 5½ cents. Other classes will benefit proportionately.

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Annapolis Consumers Complain

The city of Annapolis, Md., has filed a complaint with the Maryland Public Service Commission asserting that the rates charged there by the Annapolis & Chesapeake Bay Power Company for energy and gas are in excess of those charged in neighboring communities of similar and smaller size. A similar complaint against the utility is made by residents of other places served by it. The Annapolis & Chesapeake Bay Power Company is being operated by a receiver, against whom the complaint is brought. The complaints assert that the utility is controlled by interests allied with the Consolidated Gas, Electric Light & Power Company of Baltimore.

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Metropolitan Rates Still Agitated

No determination of various rate issues affecting Greater New York and adjacent areas has yet been made by the State Public Service Commission. The Westchester Lighting Company has prepared rates to cover that part of Bronx Borough which it serves which, the commission says, will mean a saving of $175,000 a year to the company's customers in that borough. Morris L. Cooke, a trustee of the New York Power Authority, has attacked the Westchester company's rates, saying: "Except for the quaint rates on the Island of Nantucket, I do not recall as outstanding an example of high electric rates." In Brooklyn more than 100 places of worship have joined in the attack against the new rates of the Brooklyn Edison Company.

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ELECTRICITY'S PART ON MACKINAW DOCK

—*Photographed for* ELECTRICAL WORLD.

A recent extension of the Michigan state dock at Mackinaw involved the building of a 60-ft. elevator through which, by means of a 60-hp. motor, automobiles can be elevated to the upper deck of ferryboats for transportation across the strait. Floodlamps are contained in the double-unit post.

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Shelby (N. C.) Plant Stays Public

Withdrawal of an offer by the Southern Public Utilities Company to pay $1,100,000 for the Shelby (N. C.) light plant is announced, following local opposition to the sale. The city purchased the plant eighteen years ago from private owners for $13,000. Advocates of the sale based their argument on the statement that the purchase price would virtually free the city of debt.

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California Urged to Develop Power

Construction and operation by the State of California of an electric transmission line from the proposed Kennett Dam, Shasta County, to Oakland, with a branch down the San Joaquin Valley as far as Merced, as a part of a statewide water development program, has been suggested by Louis Bartlett, former Mayor of Berkeley. Mr. Bartlett sees a net yearly revenue of $500,000 from such a development.

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Turlock-San Joaquin Agreement

The Turlock Irrigation District and the San Joaquin Light & Power Corporation have applied to the California Railroad Commission for an order approving an agreement for the sale by the district to the power company of surplus electric power manufactured at the Don Pedro and La Grange power plants. Should depletion of storage between June 1 and December 31 of any year render Turlock unable to generate enough energy for its own purposes, the San Joaquin company will supply it up to 5,000 kw. The irrigation district will buy the Hickman substation and other property of the Pacific Gas & Electric Company.

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To Build Farm Service

At Amherst, Mass., on March 16-18 a rural electrification institute will be held at the State College under the direction of Prof. C. I. Gunness, head of the department of agricultural engineering. The gathering is sponsored by the rural service committee of the New England Division, N.E.L.A., and the college. It is designed to furnish intensive training in a variety of problems bearing upon the use of electricity on the farm and is for the benefit of rural service engineers of power companies, county and home demonstration agents.

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Rate Jurisdiction in New Mexico

A decision has been rendered by the New Mexico Supreme Court to the effect that an order of the State Corporation Commission declaring existing rates of the Raton Public Service Company reasonable is not reviewable. The court also held that redress of individual discrimination by a utility company is not within the commission's jurisdiction and that allegations of a broken rate contract state no grievance under such jurisdiction.

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Los Angeles Bureau Accounts

Recommendation that engineering studies be undertaken with respect to related phases of the Bureau of Power and Light and the Water Department of the city of Los Angeles has been made to the Board of Water and Power Commissioners by an accounting concern following an analysis of the department's accounting systems. This recommendation is the result in part of informal charges that favorable figures

in the Bureau of Power and Light's financial reports have been at the expense of the Water Department, particularly in costs connected with the Owens Valley aqueduct system. There have been in recent months consolidations of activities within the two departments, executed to eliminate duplication of effort and expense. Further changes are recommended in the accounting firm's report.

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Free Window Dressing Succeeds

Free window-dressing service for electrical dealers has been restored by the Edison Electric Illuminating Company of Boston after temporary discontinuance. The plan was inaugurated in 1927, and more than 125 dealers took advantage of it, nearly all of whom have requested the resumption of the displays following a material falling off in appliance business.

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Dry and Wet in Colorado

Though eastern Colorado is thought to face a dry spring and summer, the western watershed has enjoyed heavy snowfall, which forecasts ample water for hydro-electric generating and irrigation purposes, according to the State Engineer, M. C. Hinterlider. Both the Arkansas and South Platte River basins are reported subnormal as to moisture, according to the survey. In areas fed by these streams only reservoirs with older water rights will be able to fill, and storage at present is far below average. March and April snows, such as prevailed in 1931, may relieve the situation. Snow at high altitudes in southwestern Colorado is from 4 ft. to 10 ft. deep, which is 50 per cent above normal, and storage is also 50 per cent above normal. That district, tributary to the San Juan and Las Animas Rivers, suffered a severe drought last year.

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Powerful New Magnet Helps Ceramic Industry

An electromagnet of great strength developed by S. G. Frantz and G. W. Jarman, Jr., of New York to attract minerals and other substances with low magnetic qualities was described on February 16 before a convention of the American Institute of Mining and Metallurgical Engineers held in New York City. This magnet, it was explained, is of particular interest to the ceramic industry for the removal of iron-stained particles from sands and clays which go into the manufacture of glass and sanitary ware. The mixture of valuable and worthless material, is fed through the machine like a stream of dry sand particles in quantities of from 1 ton to 5 tons an hour. The time required for the passage of any of these particles through the magnetic force is about one-twentieth of a second, and a moderate-sized machine will sort or separate more than a million of these particles in a second.

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Electric Conveyers Enter Tunnel-Building Field

Advantages of continuous electric conveyor handling of excavated material are said to have been realized for the first time in such work in the construction of the submarine tunnel now being driven between East Boston and the business section of Boston proper. Heretofore in such under-water projects where air-pressure chambers and locks are necessary it has been assumed impossible or undesirable to develop air-lock conveyors to handle the excavated material between the shield, where the "muck" is released, and the shaft hoisting equipment which brings it to the surface. In Boston not only has the feat been accomplished but excavation costs are said to bave been notably reduced thereby.

Interlocked, motor-driven, parallel material feed conveyors have been used with elaborate safeguards to protect the workers and continuity of operations. About 2,400 hp. in motors is used.

Electric Furnaces Now Superheat Gray Iron

By skillfully co-ordinating the operation of blast furnaces and electric furnaces the high quality and uniformity of output necessary in automotive metallurgy are now obtained without excessive price penalty by the Ford Motor Company. This organization has in one installation six 15-ton Herault screw-lift furnaces which are used for superheating gray iron. According to Samuel Arnold, 3d, a Pittsburgh consulting engineer, who addressed the February conference on industrial process heating at the Case School in Cleveland, the present production is approximately one ton per minute per furnace, and this can be increased if necessary.

For this installation from 60 to 65 per cent hot-blast furnace metal is used, and in addition to the battery of electric furnaces there are three large mixers of 400, 600 and 1,000 tons capacity. The hot-blast furnace metal is stored in the mixers, and to this is added cupola metal obtained from melting down a mixture of iron and steel scrap. The analysis is approximated in the mixer and the metal tapped into ladles mounted on electrically driven meggers, these ladles serving the Herault furnaces. There the metal is superheated in about fifteen minutes and then tapped.

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HITCHING THE WORLD'S FAIR TO A STAR

—*Acme*

Orestes Caldwell, former Federal Radio Commissioner, shows with a Burgess selenium cell and a flashlamp how light which left Arcturus just forty years before—as Chicago held its former World's Fair—will start the fair of 1933. A model of the Yerkes Observatory and a view of the fair grounds, with the city behind, completed the demonstrator's equipment. A flash on the light-sensitive cell in the dome transmitted the impulse.

EDITORIALS

L.W.W.MORROW
Editor

Better street lighting would avoid $130,000,000 social waste

ACCORDING to the National Safety Council the economic loss due to motor-vehicle accidents in 1929 was $850,000,000. About 60 per cent of these accidents occurred in cities, and of these about 25 per cent happened at night. Investigations have indicated that 17.6 per cent of the night accidents are due to inadequate light. Using these figures, Thomas W. Rolph, chief engineer of the Holophane Company, says that it would be conservative to figure that at least $26,000,000 loss due to traffic accidents could be prevented by better street lighting, although other engineers have estimated that the saving would be $75,000,000 to $100,000,000. The annual loss due to burglary and theft is about $250,000,000—an economic loss due primarily to night crime. Cleveland's experience after better street lighting would indicate that first-class street lighting would reduce this national loss about $100,000,000, although Mr. Rolph conservatively places the saving at not less than $30,000,000.

Averaging the extremes of these estimates, it appears that an economic waste of about $130,000,000 a year could be saved from these two sources alone by better street lighting. On the basis that $2.50 per capita would supply good street-lighting equipment throughout the country and that present street-lighting investment is $1.19 per capita, it would take an additional investment of about $75,000,000 to avoid a social waste of about $130,000,000 due to traffic accidents, burglary and theft. In other words, the saving in one year would pay for nearly double the expenditure needed. Discount all estimates by a further halving if one wishes, and the investment would still be more profitable than most outlays are assumed to be. It is a field of development that should appeal not only to manufacturers of street-lighting equipment and utilities but to those manufacturers who would furnish associated supply and service equipment.

Aiding the local merchandisers

THERE is a feeling among many students of merchandising that the manufacturers and jobbers are shirking their share of responsibility for trying to get local co-operation in merchandising. Either they assume that the utility should coach the retailer and distributor or they take the selfish attitude of educating and helping their own affiliated merchandisers. In very many cases they are simply inert in making contacts with and helping retailers.

It is pretty well recognized that distribution efficiency starts in each community and cannot be instituted by a general and uniform national plan. Each local group, however, can co-operate and learn to merchandise efficiently, and the promise of economical market development lies in this plan. The experts in practical merchandising should be found in the ranks of the manufacturers and jobbers and not in the utility organizations. Moreover, the chief merchandise incentive should rest upon the manufacturers and jobbers—they are interested in selling their products and not in load building.

An organized effort by manufacturers and jobbers to develop local practical and co-operative

merchandising plans is in order. The utilities, dealers and distributors will co-operate if the plan is presented and kept in front of them continually. It is undoubtedly true that the failure of many merchants and of utility commercial departments to make profits has resulted from the fact that manufacturers and jobbers have been content to place their products and to leave to their own resources those in control of sales outlets. National advertising by manufacturers to create a demand by consumers is not enough. They must organize to have that direct and continued contact with retailers whereby they are taught how to sell at a profit and how to develop a market by co-operation. This aspect of merchandising has been neglected too long by the primarily interested manufacturers and jobbers.

Door-to-door surveys practicable

GOING from house to house to sound out the sentiment of customers toward utilities is a delicate matter. The fear has been that, unless discreetly done, it will arouse suspicion instead of create confidence and provide bases for corrective practices. If one company's extensive experience is typical, the fears are groundless and the results wholly justify the move.

Customers welcome the personal visit if it is aimed at giving them a better understanding of the unutilized possibilities of electric service, of the equity of rate items, of the causes affecting the serviceability of appliances. Incidental to the aroused appreciation of the customer is the opportunity afforded him (or her) to give vent to fancied grievances against the utility in particular and everything in general. The politicians think they know what people think. But one thinks only as long as he does not know; when he knows he need not think.

Trained survey specialists may, of course, be used, but there is more virtue in using the utility's staff. There is no better way of educating and testing the employee concerning his grasp of the fundamentals of utility service. The rest of the program hinges on choosing the right employee to visit each stratum of customers, choosing the right time of day, the right approach, and then providing for a concise report and digest of the facts and impressions gleaned. Briefly, a direct survey links the personality of the company with the personality of the patron as positively as the wires tie his home to the heart of the company's system.

Industry integrated

ON TRIAL as it is, it behooves capitalism to give a convincing demonstration that it is able and willing so to organize and administer its functions and operations as to make its use of the resources of nature and the agencies of business result in the greatest good to the greatest number of people. This defense by demonstration has two phases. One is concerned with the distribution of the rewards and benefits of industry and other productive activity. The other is definitely the task of the technologist, because it is purely a matter of controlling, modifying and directing physical forces and things. It is the job of integrating all forms of industry into an operating organism that makes the most economical use of materials, of energy and of human labor.

A conspicuously good example of what this work contemplates will be afforded by the series of four articles by Dr. A. H. Dyckerhoff that begin in this issue of the ELECTRICAL WORLD. The series deals with the co-ordination of availability, demand and usefulness of form of energy as between electric and gas utilities and steel plants in the Chicago district. Gases of various kinds are process products or by-products of steel making. These gases are applied in greater or less degree in all plants to produce heat and electrical energy.

But no steel plant that is forced, either by physical circumstances or by prejudiced opinions of its operators, to be a self-contained energy unit can attain the point of absolute economy that would otherwise be possible to it. For instance, Dr. Dyckerhoff states, as a result of his analysis, that blast-furnace gas, which is largely used in steel plants for the generation of electricity, has in that application the least value of any in which it might be used. More profitably that gas might be used to increase the output of coke-oven gas to be sold to the gas utility and the power requirements of the steel plant be supplied by the purchase of electricity.

It is in these matters of greatest economic use of materials and forces that the engineer can ac-

complish his part of the task of proving that capitalism is not insensate, that it is capable of integrating its functions and operations to eliminate at least the more glaring wastes that characterize industry today.

Value of silicon steel in the electrical industry

PREVIOUS to 1905 no special iron or steel was available to the electrical designer, for the demand for magnetic material was as yet too small to attract the attention or interest of the steel manufacturer. Designers, therefore, had to select the best material they could find among that made for other purposes.

It is now about twenty-five years since Sir William Hadfield, dean of England's steel industry, announced that alloying a small percentage of silicon with a low-impurity steel would markedly reduce hysteresis and eddy losses. American electrical engineers and their metallurgists were quick to check Hadfield's results by experiments of their own and were agreeably surprised to find that less than 3 per cent of silicon added to a low-impurity steel reduced losses 25 to 30 per cent. Several American steel makers as well as a few electrical manufacturers therefore took licenses under Hadfield's fundamental patents and lost no time in efforts to find the full possibilities with this new magnetic material.

Experiments soon showed that far greater improvement than obtained in the first experiments was possible, but that to achieve the best results was a problem requiring the highest metallurgical and mechanical skill and resourcefulness. Progress was slow, expensive and at times discouraging, but with the close co-operation of the steel manufacturers and the electrical engineers who use the steel the complex problem has been gradually solved.

The net result of these twenty-five years of intensive work is that there is now available silicon steel having losses only about 35 per cent of those with the best unalloyed steel procurable at the time Hadfield made his announcement, and the losses once ascertained are unchanging. There are also excellent indications that the development can and will be continued until still further reductions in losses are regularly attained.

Naturally, owing to the varying loads that occur during the day, it is not possible to say with any great accuracy just what this great advance in quality of steel is worth to the industry, but its total value is very large. Present savings in all transformers now operating in America alone must lie somewhere between $35,000,000 and $75,000,000 a year. No one competent to make an estimate would, we think, place it under the smaller figure, and many would place it above the higher figure.

Transformer efficiencies now range mostly between 98 and 99½ per cent, according to size and voltage. Without silicon steel no such efficiencies would be possible, and the three and even four transformations often made of a given power before it reaches the consumer would be commercially impracticable.

In rotating apparatus the savings due to the use of silicon steel are not as yet so great, because the addition of silicon so weakens the steel mechanically that only 2½ per cent or less may be used with safety in rotating parts. However, the steel for almost all alternating generators and motors contains some silicon these days, and probably 25 per cent could be added to the above estimates for total savings now resulting from the use of silicon steel in America.

Tree trimming on a performance basis

WEARIED by ineffectual efforts and determined to reduce the matter to a factual basis of performance, one large Eastern utility has removed tree-trimming activities from the realm of the desirable to that of the vitally important. After some years of trimming by regular line crews and several trial schemes, three well-known, well-organized companies regularly engaged in this service were employed by the utility and certain specific territories were assigned to each of them. In such areas the individual tree-trimming companies are held responsible for wires down and are rated for performance on the wires down per 100 miles of line per year. Results have been most gratifying. Interruptions have fallen 50 or 60 per cent, dead wood is cleared from all trees within 100 ft. of either side of the lines and public relations have been improved.

Philip Henry Gadsden

YEOMAN service in the period of the World War was rendered by Philip H. Gadsden as chairman at Washington of the National Committee on Public Utility Conditions, in which post he represented the interests of the electric light and power, the electric railway and the gas companies of the United States in connection with war problems. He was also a member and subsequently chairman of the War Board of the American Electric Railway Association. These two committees served to co-ordinate the operations and facilities of the public utilities for the purposes of the government.

In more recent years Mr. Gadsden served as chairman of the executive committee of the Joint Committee of National Utility Associations and in that capacity took a leading part in the defense of the utilities against political attack. He has also served as a director of the Chamber of Commerce of the United States and the Pennsylvania State Chamber of Commerce and as president of the Philadelphia Chamber of Commerce.

Willingness to undertake public service is perhaps an inherited trait of Mr. Gadsden's, for among his ancestors are the proponent of the Gadsden Purchase, which, subsequent to the Mexican War, rounded out the territory of Arizona and New Mexico, and General Christopher Gadsden of Revolutionary note.

Mr. Gadsden was born in Charleston, S. C., in 1867, receiving his education at Porter Military Academy in that city and at the University of South Carolina, from which he was graduated in 1888 and which in 1918 conferred upon him the degree of LL.D. He was admitted to the South Carolina bar in 1890 and engaged in active practice for seventeen years. In this period he served for six years in the State Legislature.

Public utilities claimed Mr. Gadsden's undivided attention first in 1907, when he gave up his law office to become president of the Charleston Consolidated Railway & Lighting Company, operating the railway, electric and gas properties in his native city, and vice-president of the local water company. In 1918 he was made vice-president of the United Gas Improvement Company of Philadelphia, in charge of public relations, which post he still occupies.

Ground and Distance Relays the Trend in Practice

Overcurrent, directional and pilot systems still have proper place.
Local differentiating features justify wide range of practice.
Relay engineer must participate in system planning.

IDEALLY, the goal of relay protection is, first, sensitive and positive detection of faults, and, second, limitation of the severity, duration and spread of the disturbance. The aspiration beyond that goal is to anticipate the fault before it has even started to do any damage. The aspiration awaits fulfillment, but the rational aim can be fulfilled now—at a price. Pilot wire protection, with relatively few limitations beyond cost, constitutes the virtual acme of protection. Actual system relaying in practice is found to range downward from this "last word" to a wide variety of installations that begin just above the obsolete.

For the higher-voltage, more important systems, however, the range of variety is narrower, but nevertheless wide enough to raise the question, "what is the state of the art?" The state of an art which was non-existent a decade and a half ago and has made rapid approach toward its ideal is likely to be a mixed one whether one observes what is being done or ascertains what the experts would choose to do for a specific situation. Behind these differences lie much more than mere partiality on the part of those who have the power to recommend and decide.

Relay technique has made rapid progress, but nevertheless it has trailed in conception and in application behind the accelerated expansion of systems in extent and magnitude. The protection engineer has not always or even often been a party to the deliberations which preceded the building of new stations, new transmission links, new system configurations. He has been summoned into counsel only when apprehension—or, worse, catastrophe—has elevated protection to the rank of prevention, an ounce of which is worth a pound of cure. Circuit breakers have meanwhile already been chosen, switchboard and duct space fixed, instrument transformers limited to metering needs—all without adequate regard for the job of insuring continuity of service and apparatus safeguarding through the medium of appropriate and economical relaying.

It is not strange therefore to find an outstanding element of expediency permeating much of the relay art. The more vigorous of the relay engineers refer to this inversion of proprieties as "pinning the tail on the donkey." Others in levity occasionally refer to their own improvisations devised to meet expediency situations as adaptations of the contraptions concocted by Rube Goldberg and his Professor Butts.

Relaying started on the concept that instantaneous isolation of the fault was the desired result. Too often the crude devices isolated healthy sections of the system and left healthy stations without any load and customers without any service. Some delay was needed for discrimination purposes, so the first move was to introduce a definite time of delay. Selectivity was lacking in this set-up so it was the next feature introduced. It sufficed until the number of selective time intervals and the necessary length (half a second) for each interval resulted in excessive time at the generating stations. Higher speed was next introduced in the relays and the breakers were speeded up to match them. Meanwhile overcurrent response had revealed its limitations and the current balance or differential principle had been applied to apparatus and lines. It was followed by directional discrimination. During all this period time had been the motivating idea, and it had likewise been the control factor in relay action.

Distance supplants time as the discriminating factor

The latest development has been the shift to distance as the discriminating factor in fault isolation. It was perfectly natural to recognize the possibility of detecting the location of a fault on a power system in much the same way as tests can be made by Varley and Murray loops to locate faults on communication circuits. It was equally natural to use impedance or reactance from relay to fault as the actuating factor in adjusting time of trip to nearness to the fault. The distance relay does nearly what a pilot wire circuit can do; while it costs less in general than the pilot-wire scheme, it costs more than the overcurrent selective scheme. It has a lower limit of distance for which it can function satisfactorily. It also requires back-up protection, sometimes one of the other types.

Ground relaying a supplementary innovation

Ground relaying is another new phase of development and one in which further improvement is urgent so that faults to ground, more likely to occur than phase-to-phase faults, can be nipped before they have spread to something more disastrous. Impedance grounding of systems is growing, knowledge about ground and arc impedances should grow, and with them should evolve a ground-relaying art that will close up some of the gaps in the protective system.

Not all the difference in relay practice is attributable

to the holdover of past practice nor to the mere relative costs of the present available schemes. Long single circuits are one thing from the protection standpoint; short, parallel heavily loaded ties are another. Loops differ from radials. Metropolitan systems have radically different electrical characteristics from lightly loaded suburban systems. Voltage level makes a difference. System stability limits differ widely and preservation of stability is second only to avoidance of interruption as a goal.

Other determining factors are presence or absence of grounding, whether lines are overhead or cables, comparative capacities of network links, distances involved, the character of switching facilities and, not by any means least, the rigidity of load requirements. Regard must also be had for the various operating variations that may be encountered during system disturbances or under such special conditions as arise in connection with line and apparatus repairs. Extensive and frequent readjustment of load division to conform to best economy of generation and delivery of power will also influence the choice of the relay scheme. Unless these are appropriately considered the only single scheme that could be applied in all instances of a fundamentally identical system set-up would be an academic ideal which would be unfeasible in many cases from the economic standpoint.

Relay Symbols

Over-current	Differential current
Power directional	Differential power
Distance, non-directional	Pilot wire
Distance, directional	For ground, add

Leading protection engineers were asked what they were doing or would do to provide protection for certain characteristic system situations. Hardly any of them failed to mention the fact that local modifying factors not represented on schematic diagrams were as likely to determine the protection scheme adopted as would the inherent nature of the system connection itself.

The discussion assembled herewith is offered to show how far practice approaches toward the ideal and, on the other hand, why there is contentment with a variety of less complete schemes under particular circumstances. Each assigned letter refers to the same company's response to all questions.

Case 1—Double-circuit high-tension transmission line supplying a substation which has no other power supply.

(A) Balanced current protection with high-speed relays would be used at the generator end for overload and for ground protection and at the substation end for ground protection only; the high-tension neutral at the substation is grounded. To provide phase protection at the substation end ordinary directional single-line protection would be provided. To back up the balanced protection with either line out of service a combination of directional ground protection of the directional-current type with directional phase protection of the directional-current type would be applied at the generator end. This amounts practically to Fig. 1a. This particular system situation is difficult as long as there is no power supply available from the substation end.

In our practice no distinction is made between intra- and inter-company lines. All lines are considered as subject to power flow in either direction, although there are a few cases where directional protection is not required on the original installation. On such radial lines it is possible to save money by using the same protection as would be used on a low-tension radial feeder.

Present installations are being made with high-speed directional phase relays and with standard directional ground relays. However, it is hoped to utilize faster ground protection as soon as it is available. From the stability standpoint it is more important to clear phase faults rapidly, since ground faults will not ordinarily cause instability. Almost without exception high-tension lines are provided with grounded neutral transformers at each terminal point and breakers are installed on the high-tension sides of the transformers. Extreme difficulty is encountered in trying to protect the line if the high-tension breaker is omitted or if the line has a power supply without high-tension grounded neutral.

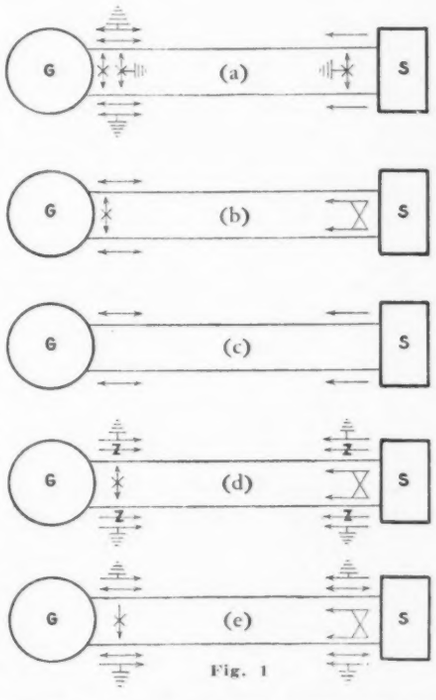


Fig. 1

(B) This company would use differential current selective relays applied to the pair of lines with back-up overcurrent relays applied to each line. High-speed operation may then be obtained with both lines in service. With only one line in service only the back-up protection would be operative and the time of clearing faults would be increased. We would recommend that an instantaneous device be installed in the overcurrent relay such that it would operate with trouble upon the line throughout about three-fourths of its length from the generating station. At the substation end we have shown differential directional overcurrent selective relays (Fig. 1b).

(C) At the generation source the lines are provided with balanced phase and ground relays and overcurrent phase and ground relays. At the substation the lines are provided with directional phase and ground relays. The directional phase relays at the substation are of course set faster than the overcurrent relays at the generating station; the same is true of the ground relays. This scheme is suitable for any operating voltage or line characteristics, provided, however, that the two lines have identical characteristics. (Fig. 1a, substituting overcurrent ground relays for the differential type shown.)

(D) We feel that, apart from ground relays, the use of overcurrent relays at the generating station and directional-current relays at the substation is most desirable. It is used by us at all points where the situation is that of Case 1 (Fig. 1c).

(E) For the best of protection we would use at the generating station directional-reactance relays and high-speed balanced-current relays. At the substation we would use directional-reactance and balanced-directional overcurrent relays. At both ends we would use ground directional relays (Fig. 1d). For a less important class of service we would use balanced-overcurrent and directional-ground relays at the generating station; balanced-power, overcurrent and directional-ground relays at the substation (Fig. 1e). Special contractual requirements might modify this conclusion as well as those cited in answer to the other situation.

(F, G) These companies subscribe to the set-up presented in Fig. 1a.

(H) If there were no modifying factors we should use the scheme of Fig. 1b. If the synchronous machines tend to become unstable we would use pilot wire to tie differential current relays at the generator end to a similar differential current installation at the substation end. This would also apply if the lines were very

short. Again, if the lines have considerable impedance we would replace the power directional relays of Fig. 1b by directional-current relays.

(I) Any one of these diagrams might be taken to represent at least three totally dissimilar electrical systems and each would call for different types of relay protection. These are:

(a) High-voltage, long-distance, heavily loaded transmission lines.

(b) Low-voltage, short, heavy ties in a metropolitan area.

(c) Medium- or low-voltage, lightly loaded lines in small towns or rural districts.

In general, parallel circuits between a generating station and susbtation would have at the generating station end an application of balanced relays. This might be of the newer type of high-speed relays if applied to a heavily loaded important system. For a small or low power system it might be made moderate speed protection. Pilot-wire protection would be given consideration in the case of short, heavily loaded cables. At the receiving end we might correspondingly have high-speed direction-distance relays, directional-overcurrent relays or pilot-wire protection.

(J) We would omit the differential-current relays at the generating station end of Fig. 1b.

(K) Our scheme is that of Fig. 1b.

(L) Lines on separate rights-of-way would have balanced protection at the generating station with directional-overcurrent at the substation. In the event of one line being out of service, time delay would be necessitated at the generating station; a distance type relay would be desirable for this purpose.

Case 2—Substation tapped off single circuit line between two generating stations.

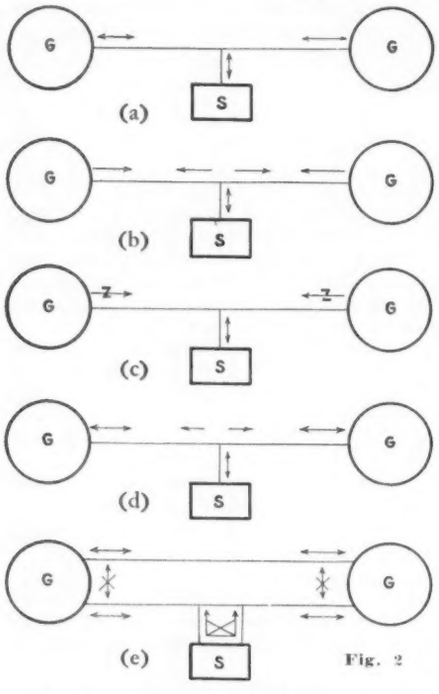


Fig. 2

(A) The scheme here would be identical with our practice in Case 1 as shown for the generating station in Fig. 1a. The substation would require no line protection, therefore the relays would be omitted at the substation, as in Fig. 2a. Oil switches at the junction point would be of very little use without a grounding transformer and high-tension potential transformers to provide directional relay action. This line scheme could be much improved upon from the service and protection standpoint by bringing each line into the substation separately from the junction point, i.e., like Fig. 5.

(B) We would use the arrangement of Fig. 2a. Overcurrent relays might be less suitable if one of the generating stations is small but has a large load in its vicinity. In that instance we would use directional relays so that a large block of power might flow from the large station into the load area, but still permit the small station to trip out quickly in case of trouble between stations.

(C) Fig. 2b indicates what we would do if the line voltage were 22 kv. or less. In case of a fault between either of the engineering stations and the substation the directional relays either side of the fault would operate and eliminate the faulty section of line. In case of a fault on the tap line the overcurrent or ground relay on it should operate faster than the directional relays between generating stations and thus leave the main line in service. Also the directional relays at the substation junction must be set long enough so as to not operate faster than the relays on the load circuits at the generating station in case of a fault on these load circuits.

If the system were of higher voltage, reactance or impedance relays responsive to line characteristics might be more desirable for phase fault protection.

(D) For a straightforward case Fig. 2a would serve the purpose. In our case other stations are connected to those shown in the diagram, consequently we would use directional-impedance relays (Fig. 2c) on these ties in order to maintain uniform timing.

(E) For protection of the highest class we would use directional-reactance and ground-directional relays at each location (similar to Fig. 2c). For a less important class of service we would use overcurrent and ground-directional relays at each location (similar to Fig. 2a).

(F) Overcurrent relaying (Fig. 2d) is our practice in this case. If, however, the generating stations were of large capacity or relatively close together a pilot-wire system would be added.

(H) For the simple situation our practice is that of Fig. 2a, with appropriate reset characteristics for each of the generating station overcurrent relays. In one instance the availability of a pilot-wire circuit led to the installation of pilot-wire differential relaying for all three functions. Where the substation is tapped to both of two parallel lines between generating stations our scheme is that of Fig. 2e.

(J) We omit the overcurrent relays on the tap to the substation.

(K) For the characteristic situation directional-impedance relays would be installed at the generating station, but no overcurrent relays on the tap line as in Fig. 2c. For large stations, close together, differential-directional relays at the three points would be pilot-wired.

(L) Duo-directional-impedance relays at all three points.

Case 3—Tie line between generating stations each of which usually has load on its own bus.

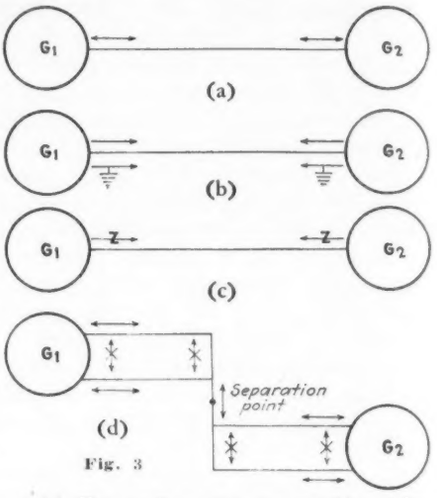


Fig. 3

(A) For such a case we would employ directional phase protection of the directional-reactance type in connection with directional-ground protection of the directional-current type.

(B) Mere overcurrent protection, as in Fig. 3a, would not suffice if one generating station has small capacity and a large load off its bus. In that event directional relays at the smaller station would facilitate clearing trouble between stations without interfering with normal transfer of power to the load.

(C) Our comments on Fig. 2 apply here. The practice is to use directional-ground and overcurrent relays at both stations (Fig. 3b).

(D) In all instances comparable to Case 3 we have other stations tied to one or other of the two shown, consequently we find it necessary to use directional-impedance relays on these ties in order to maintain uniform timing (Fig. 3c).

(E) For a long tie we should probably use directional-reactance relays and ground-directional relays at each end. For a short tie the possibilities of pilot-wire protection would be investigated.

(F) Overcurrent relaying (Fig. 3a) unless the stations were close together or of large capacity, in which case pilot-wire relay protection would be used.

(G) For the simple situation overcurrent protection. With two lines between the stations the scheme would be that of Fig. 3d, illustrating the loose-link characteristic of system operation. Both lines are bused at the prearranged separation point and the relaying designed to separate the system at that point in case of a major fault (Fig. 3d).

(J) We would follow Fig. 3d or use pilot wire for large stations close together.

(K) Pilot wire with differential overcurrent protection is our practice in some cases; other cases would be met by directional-impedance relays (Fig. 3c).

(M) Duo-directional impedance relays in place of the unidirectionals of Fig. 3c

Case 4—Three generating stations feeding into a substation.

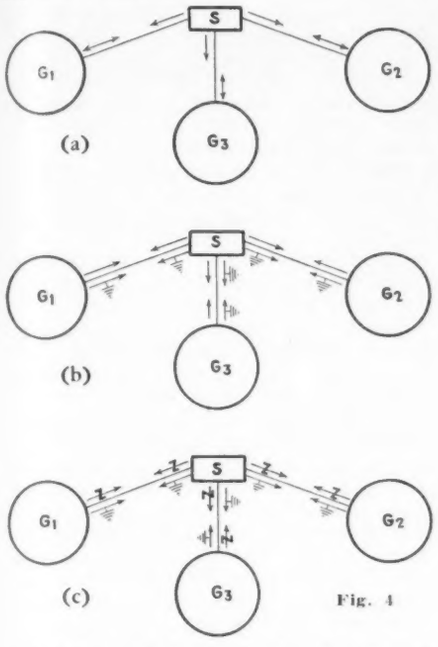


Fig. 4

(A) The scheme outlined under Case 1 would be adapted for this situation at each generating station and at the substation end of the high-tension lines.

(B) Overcurrent relays at the generating station and directional relays on the tie lines at the substation (Fig. 4a) would be supplemented by complete differential bus protection in order to isolate the station in case its bus should become involved in a fault. The overcurrent relays at the generating station should be of a highly inverse time characteristic or should have an instantaneous trip attachment.

(C) Directional-overcurrent and ground relays at all points (Fig. 4b). The diagram assumes that the substation is not the only load supplied by the generating stations. The absence of duplicate ties precludes the use of the differential protection employed in Case 1a.

(D) On our urban system other leads than the substation shown are supplied by the generating stations. We therefore find it necessary to use directional-impedance relays in order to maintain uniform timing (Fig. 4c).

Our suburban system has a case of two stations connected by single circuit to a substation and because the lines are relatively long the scheme of Fig. 4a is considered adequate.

(E) Each of the ties from the generating stations to the substation would be given directional-reactance relays and directional-ground relays at each end (Fig. 4c).

(F, G, J) Fig. 4a would be our practice.

(H) Our situation involves parallel lines in practically all instances and buses at the generating station provided with "separation points," at which the breakers would be actuated by simple overcurrent relays in much the same manner as in Fig. 3d. If we had a single tie situation we would use the scheme of Fig. 4a.

We have an instance where only two stations are connected to a substation by single circuits, but they are tied together with heavy parallel ties. We here use Fig. 4a, with the directional relays at the substation set to operate before the generators fall apart.

(K) Independently of modifying factors, our notion of the preferred arrangement would be Fig. 4c. With short, heavy lines the pilot-wire scheme would be adopted. Most of our cases involve parallel lines with differential protection. This is just an illustration of the point that apparent complexity in the system connections often makes relaying simpler than for the elementary case.

(L) Impedance relays in place of the overcurrent type in Fig. 4a.

Case 5—Three substations on a looped feeder from a single generating station.

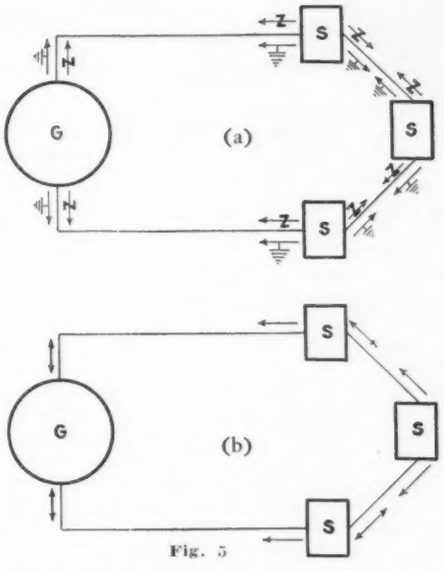


Fig. 5

(A) With a breaker at each end of each line section the relays used could be directional-reactance and directional-ground relays at each breaker (Fig. 5a). This would not be wholly satisfactory from the selectivity standpoint if any of the line sections were very short. Pilot-wire protection or double circuits in such a short section would be preferable.

(B) With us these would be industrial substations close together and pilot-wire protection would be used unless prohibitively costly. For longer distance impedance-directional relays would be used (Fig. 5a). Each substation should have bus protection, especially if the pilot-wire scheme is used on the lines.

(C) This differs from Case 2, in that daily current is supplied from the single generating station over different lines. Directional relays at the generating station are not necessary, since no fault on its bus will send fault current over the lines. Therefore the overcurrent and ground relays automatically become directional in effect. The operating voltage and the line characteristics will determine whether simple overcurrent or distance relays will be required.

(D) We would favor the scheme of Fig. 5b because of its simplicity, provided it could be used without excessively high time values. We have, however, no case just like this. Impedance relays might also be considered.

(E) At the generating station the circuits would be protected with overcurrent and ground-directional relays or with directional-reactance and ground-directional relays. At the substations directional-power and ground-directional or directional-reactance and ground-directional relays would be used.

(F) Overcurrent and directional-overcurrent relays (Fig. 5b). Unless the distances are relatively great this scheme is limited in its application to a small number of stations.

(G) We use directional-impedance relays (Fig. 5a).

(H) Fig. 5b. For short heavy cables between stations we use differential pilot-wire protection on all sections of the line in conjunction with directional-overcurrent relays at the generating station.

(J) We would follow Fig. 5b except that we would use directional-impedance relays between the substations unless the distances were short enough to justify the cost of pilot-wire protection.

(K) Our practice would be that of Fig. 5b.

(L) Duo-directional impedance type at G, otherwise as in Fig. 5a, ground relays not being mentioned, however.

Case 6—Several substations on a closed loop served also by radial feeders from a single generating station.

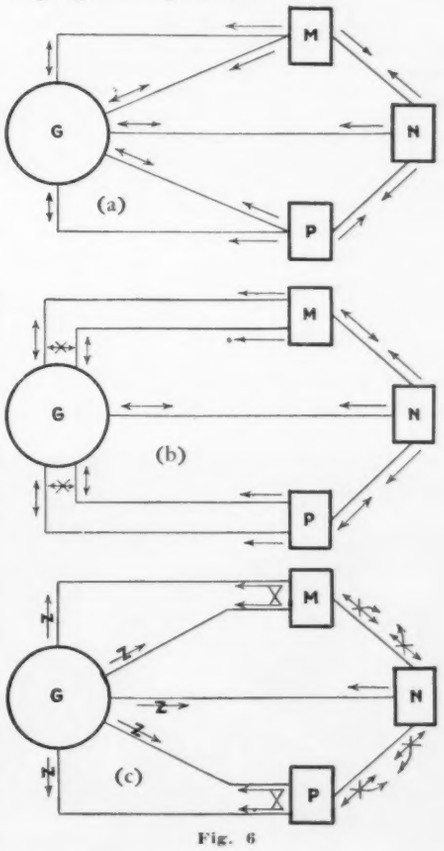


Fig. 6

(A) The scheme here would be that of Fig. 5a in conjunction with directional-ground protection of the directional-current type.

(B) Pilot wire between stations plus bus protection at each substation. With longer distances impedance relays would be substituted for the pilot-wire protection. Fast directional relays between generating station and substations.

(C) Case 6 does not inherently call for

relaying different from Case 5, even though more lines are involved. If there were duplicate lines of identical characteristics the differential scheme of Fig. 1a might easily give faster relay operation than with the scheme shown in Fig. 6a. Directional functioning is unnecessary at the generating station.

(D) The scheme of Fig. 6a would be our choice if we had such a system situation or else impedance relays could be applied as in Fig. 5a.

(E) At the generating station overcurrent (or directional-reactance, Fig. 6c) and ground-directional relays at substations on the lines to the generating station.

If this system were to operate normally closed we would use the differential current protection of Fig. 6b at the generating station in order to eliminate the time sequence; also add the power-directional relays of Fig. 6c at the substations.

(G) Directional-impedance relays at the generating station, Fig. 6c.

(H) Fig. 6a, except that Fig. 6b would apply in case the loop section and radial feeders are to be regarded as parallel lines.

(J) Scheme of Fig. 6a in conjunction with the pilot-wire protection of Fig. 6c between substations.

(K) In the scheme of Fig. 6a we would set the timing at 1.7 seconds at the generating station, 0.2 second at the substations on the lines to the generating station, 1.2 seconds from *M* to *N* and *P* to *N*, 0.7 second from *N* to *M* and *P*.

(L) Fig. 6a, but with all relays of distance type in place of the overcurrent duo- and uni-directionals.

Case 7—Two or more generating stations and two or more stations on a closed loop.

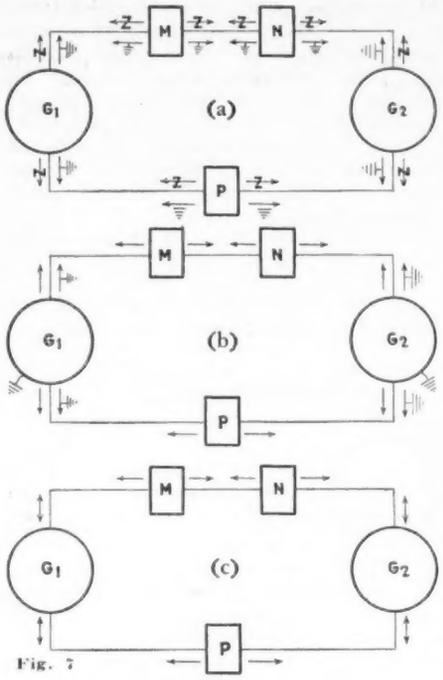


Fig. 7

(A) We would treat this the same as Fig. 5a.

(B) Impedance relays would be preferred if there is considerable distance between substations and the generating station. Directional relays might be installed to give proper sectionalizing, but the time settings would be cascaded and the settings nearest the generating station would be quite high.

(C) Regardless of the supplying of load from the (grounded-neutral) generating stations the lines at those stations should be provided with directional-current and ground relays, since it is possible to supply fault current to either of the generating sttaion buses (Fig. 7b).

(D) This set-up occurs on our suburban system and can be handled by the scheme of Fig. 7c. Impedance relays could also be used.

(E) Directional-reactance and ground-directional relays on all lines of each location (Fig. 7a).

(F) In our instance both generating stations normally feed the system (Fig. 7c) except that non-directional relays would suffice between *M* and *N*.

(G) Probably satisfactory operation could be obtained by the use of straight overcurrent protection at the generating stations with directional-overcurrent relays at the substations, although increasing the number of substations above the number shown would complicate this. Fundamentally, it is improbable that both generating stations would always have capacity on the line; in that event impedance type protection would probably be the best solution.

(H) Fig. 6c, with separation points provided in our loose-linked system between *M* and G_1 and between *P* and G_2. We also interlock the overcurrent element with the watt element on all directional relays except at the separation points.

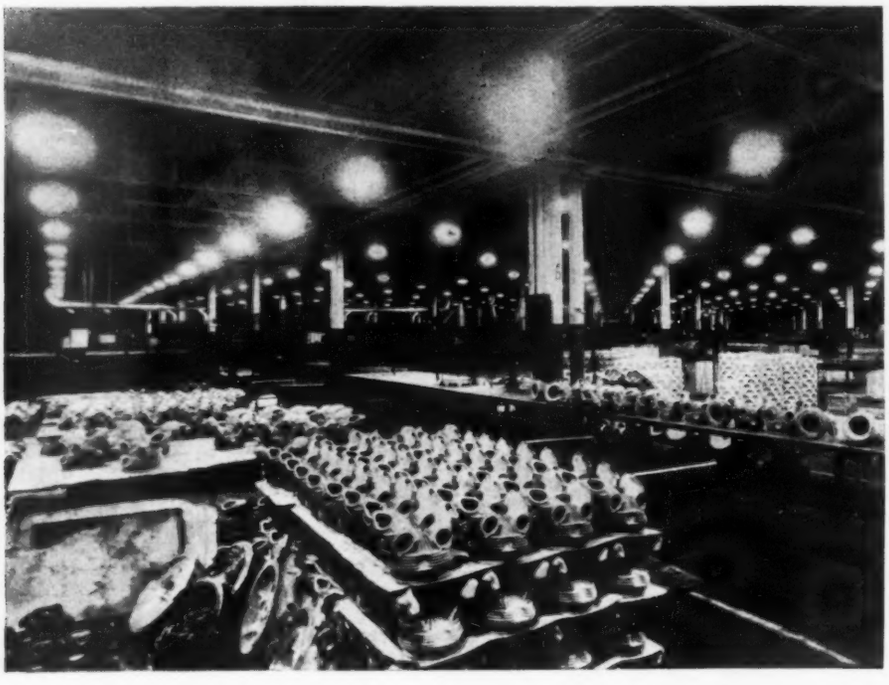
(J, K) Fig. 7a would be our practice.

(L) Fig. 7a, except that ground protection is not indicated.

▼ ▼ ▼

Aircraft Factory Uses 20 Foot-Candles

By mounting 16-in. "Ivanhoe" reflectors with 300-watt lamps 14 ft. above the floor and on a 10x10-ft. spacing the engine shop of the Pratt & Whitney aircraft factory at East Hartford obtains an intensity of 20 foot-candles throughout the working plane. This shop is 1,200 ft. long x 600 ft. wide. The illumination provided facilitates work around the floor and under tables with few objectionable shadows, and the location of the lighting units and their type and rating contribute to speedy inspection of material in process and quick adjustments and repairs on the great number of machine tools of the individually driven type with which this plant abounds. Effective sectionalization of local lighting circuits and lamp groups is provided by switch cabinets located in general on alternate longitudinal columns, all wiring being carried overhead. The absence of belts aids uniformity of light distribution.



Night view of airplane engine factory interior

Wisconsin Makes Accounting Serve Expeditious Regulation

Rate analysis facilitated.

Property acquisition costs more readily traceable.

Transactions with affiliates brought into relief.

Security issue costs a deduction from proceeds.

WISCONSIN'S commission has been following the uniform accounting classification of the National Association of Railroad and Utilities Commissioners. But recently the conclusion has been reached that this classification in a number of important respects fails to meet the needs of effective and expeditious regulation. It has been subjected to thorough re-examination and a revision promulgated which, however, leaves for future application some features which would have occasioned costly confusion if adopted on such short opportunity for preparation. The principal provisions of the recent order (2-U-66) attached to the opinion by Commissioner Lilienthal pertain to the following points:

1. Fixed capital accounts designed to show original costs.
2. Accounts framed to facilitate tracing of transactions.
3. More detailed breakdown of revenue into customer classes.
4. Adoption of straight line or sinking fund depreciation accounting.
5. Records remodeled to aid cost allocation in rate studies.
6. Stock sale commissions and expenses set up as distinct balance sheet item.
7. Segregated transactions with affiliated companies.

The motivation behind these changes was the desire to promote such accounting as would make the results a direct contribution to effective regulation. There was relatively little regard for academic theories of accounting as such. Neither was there any delusion that accounting could be so perfected that it would reduce utility regulation to the mere mechanical function of examining the accounts. The commission has said that no accounting system is "a substitute for informed judgment . . . But that judgment must be thoroughly and accurately informed. We are confident that regulation could be expedited and its effectiveness increased with a more revealing arrangement of accounting records."

The premises on which the new order is based were set out as follows:

1. So far as feasible and practicable a given account should have the same meaning at all times for all companies of the same class. In furtherance of this principle the new classification contains more specific and detailed instructions than have heretofore been in force. "We cannot see how regulation can be made expeditious if each account must be investigated anew each time it figures in a problem before the commission."
2. Capital account, particularly fixed capital, should reveal original costs.
3. There should be division and subdivision in no greater detail than is practically useful to the commission. The use of clearing accounts and the breakdown of fixed capital, revenue, income and expense accounts will in the long run save both the companies and the commission time and expense; it will also facilitate tracing a transaction from its inception to its conclusion.
4. The system of accounts should, so far as practicable, facilitate cost accounting for utility services.

In adjusting rates it is ordinarily important to know the number and type of customers to whom a distinct price schedule is applicable and the revenues and sales produced by each price schedule. The limiting factor in making full application of this principle in accounting is the multiplicity of rate schedules and the overlapping of customer classes in different companies. At this point the commission hopes that the utilities will voluntarily go further in current accounting for revenue on a rate-schedule basis than it has appeared practicable to require as a uniform practice.

The existing and obviously inadequate account 601 is replaced by the following:

I. Metered Sales

600. Residential service.
600.1 Urban residential.
600.2 Seasonal cottage service.
601. Rural service.
602. Commercial and industrial.
602.1 Lighting.
602.2 Combination lighting and power.
602.3 Power.
602.4 Miscellaneous.
603. Heating, cooking and/or refrigeration, special services.
604. Railroad corporations.
604.1 Railroad corporations—affiliated.
604.2 Railroad corporations—non-affiliated.
605. Other electric utilities.
605.1 Affiliated electric utilities.
605.2 Non-affiliated electric utilities—private.
605.3 Non-affiliated electric utilities—public.
606. Government and municipal service at special rates.
606.1 Street and highway lighting service.
606.2 All other service at special rates.

II. Unmetered Sales

610. General consumers.
611. Railroad corporations.
612. Other electric utilities.
613. Government and municipal service at special rates.
613.1 Street and highway lighting service.
613.2 All other service at special rates.

Cost disparities are minimized

A new departure has been instituted in public utility accounting practice in connection with the fixed capital accounts. A new item has been set up under the designation "Fixed Capital Purchase Adjustment" (No. 359).

This is intended to include the "difference between (a) the amount approved by the Public Service Commission for the purchase of any utility plant or property constituting an operating unit or system and (b) the actual original cost of constructing and installing such plant, less the amount or amounts standing in the depreciation or retirement reserve or any similar reserves and accounts of the vendor pertaining to the property at date of acquisition." Entries shall be based on estimates if the actual cost is not known. This provision is not made retroactive; it applies only to purchases made subsequent to January 1, 1932.

The real purpose of this account is to perpetuate records of original cost of the property which have been built up under a system of commission regulation of accounts and to minimize variations in cost records merely by reason of changes in ownership. Differences between the approved purchase price and the original cost of the property may be justified by several factors, e.g., a change in commodity price level, valued right to do business in a territory, a measure of anticipated economies and payment for what is essentially "good will." Retirement of items in this account is not rigidly stipulated, but the topic will be explored in a general hearing when the first acquisition case gives occasion to make specific treatment.

The commission believes that the fixed capital accounts should provide for more positive segregation of the items pertaining to transmission and distribution. The present schedule affords several subdivisions for each of these, but it does not afford as clear-cut segregation as is desired for effective regulation. Such partitioning is admittedly difficult, but the commission believes it can be done and should be done. It will be a subject of further consideration as the program now undertaken moves toward its fuller consummation.

Capital costs segregated

In the balance sheet certain items now record elements of quite diverse character under the same grouping. Account 101 ("Fixed Capital") at present includes fixed capital in service, fixed capital involved in items under construction and fixed capital in property held for future utility use. The revision calls for separate accounts for each of these quantities.

When the commission proposed that commissions and expenses in issuing capital stock be set out as a separate item on the balance sheet the utilities offered serious objection and the commission's own conference committee was divided in its opinions. At present the two items are lumped under organization. This seems clearly wrong to the commission. The upshot has been that the two items are to be segregated as a separate balance sheet item. The utilities preferred to have it established as a fixed capital sub-account.

These costs are costs of acquiring capital and not costs of property, and therefore to include them in the fixed capital account appears to the commission to be not only misleading but inaccurate. Payments for equipment are a productive application of funds realized and available for use. On the other hand, selling expense and commissions are items of financial expense directly deductible from the gross proceeds of the security issue itself.

The commission acceded to the preference of the utilities in connection with the procedure in writing off these commissions and expenses against surplus or stock premium. It is thus permissible to eliminate them from the balance sheet. The commission also agreed with the utilities with respect to the offsetting of premiums against commissions and selling expense as well as the payment of dividends out of premium account in so far as the law of the state permits it.

Transactions with affiliates clarified

With regard to transactions between operating and affiliated companies the commission said in the order:

"One of the most serious deficiencies of the existing classification of accounts is that it does not adequately provide for recording, under separate and appropriate headings, transactions with affiliated companies. The importance of the relations between operating companies and those affiliated companies which render them supervisory, financial, engineering, purchasing and other services has been recognized by the 1931 Legislature by the passage of Section 196.52 empowering us to regulate these transactions. One of the first steps in making this jurisdiction effective in day-by-day regulation is to improve the accounting classification as it applies to these relationships."

Twelve new accounts for transactions with affiliated companies replace the two which inadequately provided for the new industry situation in the old classification. In operating expense are three new accounts, not including a clearing account from which apportionments are made of all payments to affiliated interests for services received from them, except those which are inserted under the new accounts set up at other points. This has the advantage of recording at one place all items that are not prominently such items at other points in the books.

In the past extensive accounting analysis has often been necessary to trace relationship between payments and the manner in which their breakdown has been recorded under various headings. A variety of services are rendered, construction and maintenance jobs are numerous and several distinct operating departments are involved in the segregation and allocation of the costs. The new set-up is intended to clarify the recording of the breakdown of all omnibus items of payment to affiliated and supervisory companies.

The account is known as "Services and Expenses of Affiliated Interests." It is a reservoir or common assembly point of all transfers of funds or credits between utilities for services rendered and received. The charges to this account are to be classified into construction, maintenance, plant operation, commercial, new business, merchandising and jobbing, financial and such other classes as may become necessary. Transfers out of this clearing account will be made in such manner as to reveal the relationship between all payments and the capital and operating entries to which they are ultimately charged.

There are, however, three items which do not pass through this clearing account, but are covered by corresponding accounts under general administrative expense. Supervision Fees (No. 783) or management fees may be based upon a percentage of gross earnings or constitute a fixed annual or monthly payment. "Supervision Expenses" (No. 784) has been created for payments to the affiliate to reimburse it for traveling and like expenses not included in the periodic and stipulated payment. A third general administration item provides for "Special Services of Affiliated Interests" (No. 785)

to cover payments for services which cannot be assigned directly to specific expense accounts.

The existing classification provides for retirement expense and retirement reserves, the term "depreciation" not being used. But as the commission construes Section 196.09 enacted by the 1931 Wisconsin Legislature the law of the state requires depreciation accounting. Consequently the commission is requiring class A electric utilities to account for depreciation either on a straight-line or sinking-fund basis as the commission may direct in specific cases, meanwhile continuing their retirement reserves until the transition is effected.

▼

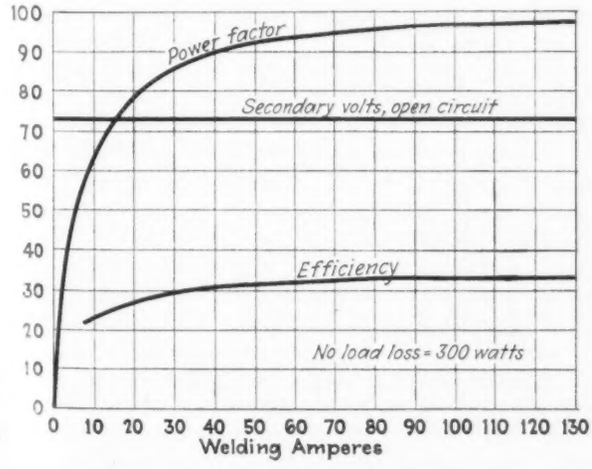
Oscillator Stabilizes A.C. Welding Arc

By J. B. GIBBS
Transformer Engineer
Westinghouse Electric & Manufacturing Company, Sharon, Pa.

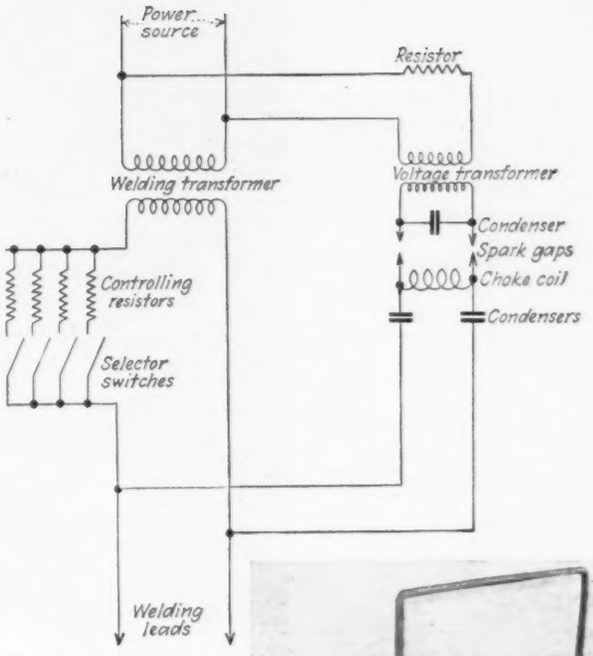
Addition of a high-frequency oscillation circuit in parallel with the secondary of a welding transformer eliminates most of the obstacles which have prevented a.c. welding from competing favorably with d.c. welding. It avoids the necessity of a high open-circuit voltage in the secondary of the welding transformer to re-establish the arc when it is interrupted. The high voltage of the oscillator performs this function and maintains ionization in the arc space so that the arc is far less likely to be extinguished. On the other hand, the high frequency of the oscillations prevents annoying or harmful physiological shock.

As a result the transformer efficiency and power factor are high, the arc is easy to hold, small currents can be controlled for thin work and either bare or coated electrodes are feasible.

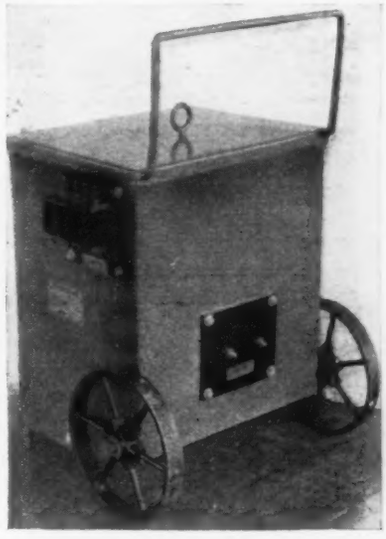
The voltage transformer used for excitation of the oscillator has a high-voltage secondary feeding the oscillator circuit through spark gaps and blocking condensers keep the welding current from shunting through the oscillator reactance. Ionization of the arc space at the work by the high-frequency voltage removes the resistance which would otherwise require high initial welding voltage to break it down in establishing and re-establishing the arc. As a consequence the open circuit voltage of the welding transformer is only 73 volts. Danger of shock is minimized. No load losses are reduced in conjunction with higher operating efficiency and power factor and operating costs are correspondingly less.



Power factor and efficiency improved



A.C. arc stabilized by oscillator

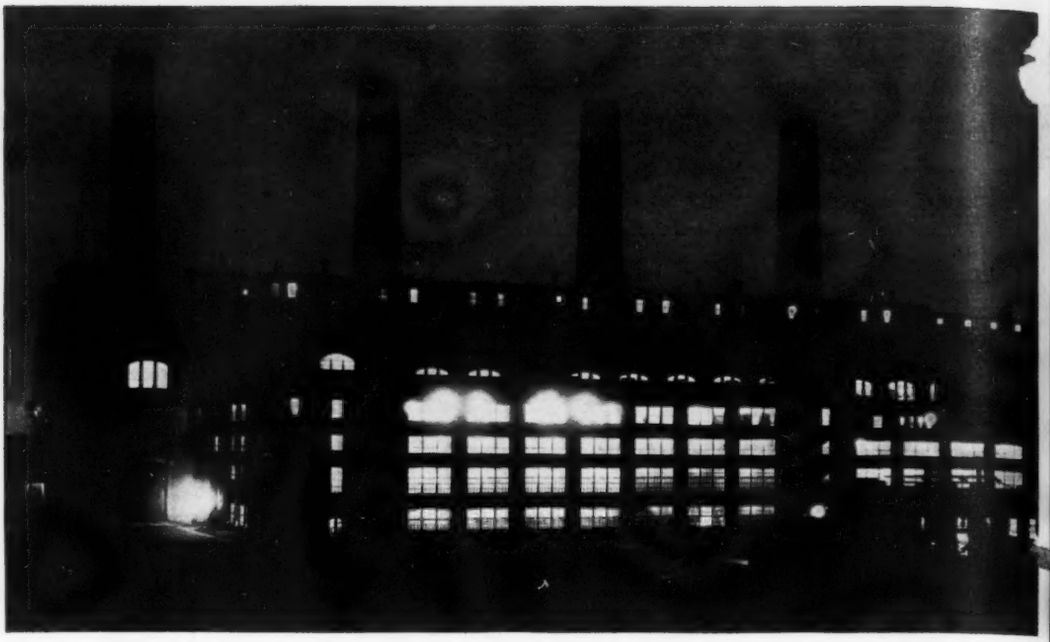


Compact portable a.c. welder

Power supply is connected to studs between wheels; welding leads attached below switches which regulate welding current from 8½ amp. to 125 amp. in steps of about 8½ amp. each.

The weld quality is equal to that of the d.c. weld. A series of ten sample welds between hot rolled steel plates, showed an average tensile strength of 52,000 lb. per square inch. Failure occurred at the weld in six of the samples and about 1½ in. from the weld in the four others.

The operator who is familiar only with d.c. welding will notice at the outset that it is usually not necessary to touch the work with the electrode when the oscillator is combined with the a.c. arc. The arc will start as soon as the electrode is brought near the work. The molten pool is usually smaller and less agitated than that of a d.c. weld. This does not, however, mean that the weld is failing to "burn in." The a.c. weld has less penetration than one made with the same number of d.c. amperes. This is a distinct advantage in welding thin plates. If more penetration is wanted on heavier work, a larger current and larger electrode can be used and this increases the speed of welding.



Crawford station, Commonwealth Edison Company

By
A. H. DYCKERHOFF
Chicago, Ill.

Regional Energy Co-ordination

JUST as among the electric utilities interconnections between systems have reduced investment and operating costs, so still greater economies can be achieved by coupling up the energy structures of plants of different groups of industries. From this conception comes the linking up of energy systems of companies and of industries of different genre which have more than one form of energy at their disposal, and it further embraces the exchange of energy in a planned manner for the purpose of the greatest economy. Of the various combinations possible, that one which might be established between the electric and gas utilities and the basic plants of the iron and steel industry is of greatest importance, because of the vast amounts of energy involved in various forms, the greatly different intrinsic values of these forms and the interchangeability of them. The public utilities work mainly with energy in the following forms in addition to coal: Coal gas (coke oven gas), water gas (carbureted), natural gas and electricity.

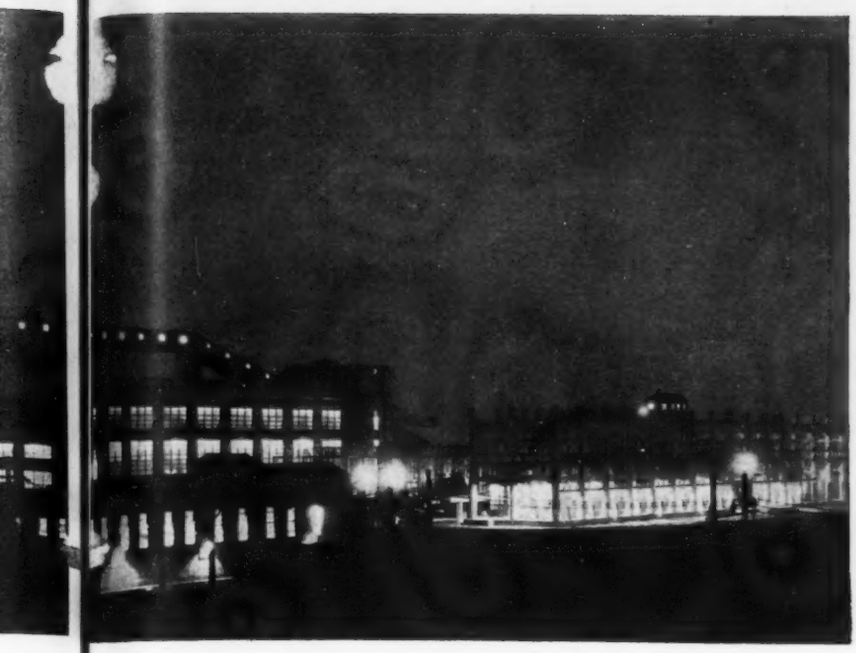
The basic plants of the iron and steel industry have, besides coal, the following kinds of energy at their disposal: Blast furnace gas, coke oven gas, producer gas, coke breeze, tar and oil, waste heat and electricity.

Integration of electricity systems into large operating units has resulted in large-scale advantages of economy and service availability. Extending the idea of interconnection to embrace gas as well as electric utilities and to include also basic industrial processes enlarges the concept to the status of a regional economic co-ordination. Three subsequent articles will deal with the energy aspects of steel plants and the justification for tie-in with gas and electricity systems.

For practical reasons, coke oven gas, natural gas and electricity can best serve as direct means for coupling up the energy structures of the two groups and for exchanging energy between them; however, indirectly, all other forms of energy in the basic steel plants take part in the coupling of the energy structures, since they supplement each other or can be interchanged generally within the steel plant.

The consumption of electric power per capita in Chicago has grown within twelve years from 500 to about 1,150 kw.-hr., during which period the average energy required by 1 kw.-hr. generated by the utilities was reduced from about 27,500 B.t.u. to 16,200 B.t.u., corresponding to a decrease of about 41 per cent. In the same space of time the consumption of gas increased from about 10,000 cu.ft. per capita to about 13,000 cu.ft. Such persistent increased consumption naturally led to the building up of very large energy structures of the electric and gas utilities in the Chicago district, as evidenced by the map, which shows the extent and magnitude of these systems and also the geographical location of the basic plants of the iron and steel industry. As a result of such requirements, the greater Chicago region demands a total generating capacity of about 1,600,000 kw. (1930) and a normal delivery of gas in excess of about 54,000,000,000 cu.ft. per year.

The growth of the Chicago iron and steel industry has occurred practically parallel with that of the electric utilities. It can likewise, as do the Chicago utilities, boast a rate of increase in producing capacity hardly matched anywhere else, which capacity amounts to about 11,000,-



Blending of energy structures of electric and gas utilities with those of plants of iron and steel industry results in economies to all three participants.

Study of electricity and gas supply conditions in Chicago area discloses large opportunities for benefit to steel plants from such blending.

on Embraces Steel, Gas, Power Industries

000 tons of raw steel per year, lagging the capacity of Pittsburgh by only 1,500,000 to 2,000,000 tons. As is evident from the map, the basic iron and steel plants are favorably located for an exchange of energy with the electric and gas utilities.

Experience has shown that a certain reactionary attitude is manifested by part of the "steel mill fraternity" when discussing the exchange of energy with the utilities. This attitude is due partly to a fear of losing a certain degree of independence in operating the plants and partly to a certain inconvenience expected with an exchange of energy. In addition, many operating men are too deeply involved in the problems of their own plants, losing sight, thereby, of new developments and economies. Frequently, a shortsighted view is taken, because there is, for instance, certain excess equipment available at the time (as, for instance, some spare boiler capacity), requiring but the addition of a generating unit to meet an increase in electrical load.

For these reasons the merits of regional energy co-ordination, as applied to the exchange of energy between the utilities and steel plants, can be discussed fairly and appraised at their true value only through understanding of and adherence to the following conditions and procedure:

1. The theme should be considered from a viewpoint that all utilities and industrials are included in the national social fabric and to it owe responsibility for efficient and economical operation.

2. A long-range view should be taken, a view that will take into account future technical developments that may be expected in steel plants and utilities.

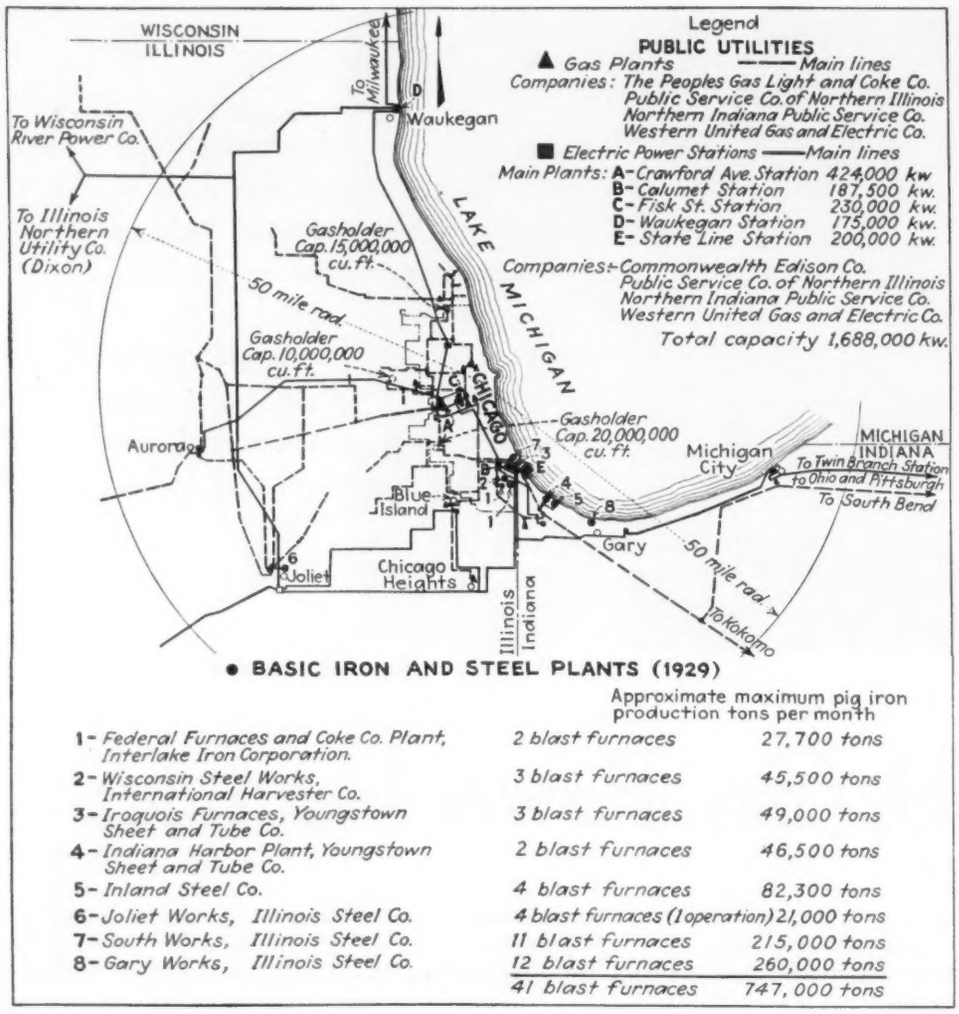
3. The same units should be applied in any comparison, i.e., kind and price of coal, kind of service, etc.

4. The procedure must start by the making of an abstract study of the energy structures of each group which aims at blending the three energy structures into one unit.

The Electric Utility—There are two reasons why the electric utility inherently has the lead in producing cheap electric power as compared with the plants of the iron and steel industry. First, there is the rapid growth of the demand for electric energy and thereby the possibility of the immediate application of latest improvements. Second, there is the great diversity of power demand which permits spreading investment costs over a large number of customers. The normal annual increase of energy generation in the Chicago area is about 12 per cent and requires the installation of additional capacity of about 150,000 kw. per year, which can be installed readily. The constant increase in load, coupled with the steady improvement in large capacity turbine design and of large power plants in general, which already have resulted in economies as low as 12,500 B.t.u. per kw., favors fundamentally the electric utilities, leading to greater economies and thereby ultimately to lower rates.

The second reason for the inherent lead of utility power plants over private power plants is their great diversity of load. This is particularly apparent as between the utility system and the steel mill power systems. For the purpose of ascertaining this diversity, data covering several years are given in the accompanying table. From these data it will be seen that the diversity factor of steel plant and utility power systems varied between 0.516 and 0.708 and amounted in average to 0.623. Therefore, if one wishes to be conservative, a diversity factor of 0.715 is a safe figure to use.

The two advantages cited above, favoring the utilities



• BASIC IRON AND STEEL PLANTS (1929)

		Approximate maximum pig iron production tons per month
1- Federal Furnaces and Coke Co. Plant, Interlake Iron Corporation.	2 blast furnaces	27,700 tons
2- Wisconsin Steel Works, International Harvester Co.	3 blast furnaces	45,500 tons
3- Iroquois Furnaces, Youngstown Sheet and Tube Co.	3 blast furnaces	49,000 tons
4- Indiana Harbor Plant, Youngstown Sheet and Tube Co.	2 blast furnaces	46,500 tons
5- Inland Steel Co.	4 blast furnaces	82,300 tons
6- Joliet Works, Illinois Steel Co.	4 blast furnaces (1 operation)	21,000 tons
7- South Works, Illinois Steel Co.	11 blast furnaces	215,000 tons
8- Gary Works, Illinois Steel Co.	12 blast furnaces	260,000 tons
	41 blast furnaces	747,000 tons

Steel plants and utility system in the Chicago area

The concentration of steel plants and large electric and gas utility capacity makes the Chicago district an ideal territory for the co-ordination of regional energy supplies and needs.

system, find expression in the very low rates to large power customers. This is particularly true for the greater Chicago district, as is evident from the graph, giving the present price of 1 kw.-hr. at various loads and load factors. This price applies to the rate of the Commonwealth Edison Company, but holds within a few per cent for the entire greater Chicago district. The power requirements of steel mill systems show generally a high load factor, which is represented by curves *B* and *C*, applying to steel plants when operating at a good rate of production. They are based on actual determinations, curve *C* giving average conditions and curve *B* representing individual monthly readings. Curve *B* will serve later as a basis for the comparison between purchased electric power and power generated by a typical steel plant. The characteristic rate form of the Chicago area —unit energy price reducing as load factor and demand increase—taken in conjunction with the load factor curves *B* and *C* for steel plants determines curves *G* and *H*, which show the price of 1 kw.-hr. on Commonwealth Edison service as a function of the load of steel plants operating at good rate of production. Curve *G*, corresponding with curve *B*, will serve as a basis for the determination of the merits of the co-operation of plants of the iron and steel industry with the public gas and electric utilities.

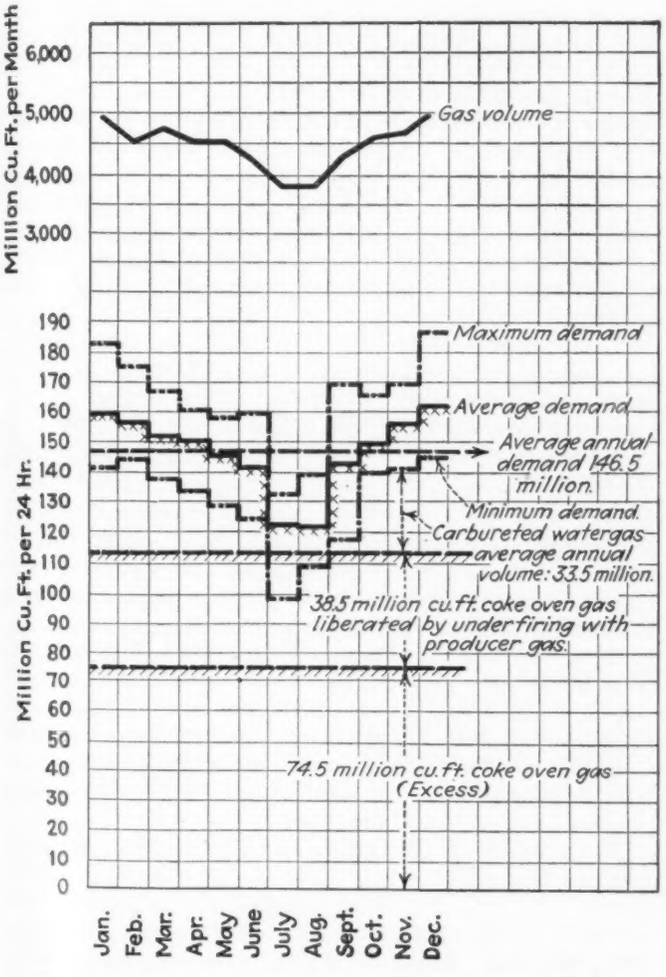
Gas Utility—The requirements of the gas utility system are represented by the accompanying diagram, which

Diversity Factor of Electric Utility and Steel Plant Power Systems

Plant	Year 1923		Year 1925		Year 1926		Year 1928	
	Maximum Load of Year Kw./ ½ Hour	Load of Plant Kw./½ Hour, at Time of Max. Load of Utilities System	Maximum Load of Year Kw./ ½ Hour	Load of Plant Kw./½ Hour, at Time of Max. Load of Utilities System	Maximum Load of Year Kw./ ½ Hour	Load of Plant Kw./½ Hour, at Time of Max. Load of Utilities System	Maximum Load of Year Kw./ ½ Hour	Load of Plant Kw./½ Hour, at Time of Max. Load of Utilities System
I								
A	1,992	384	2,328	1,560	2,036	1,164	1,992	1,056
B	4,404	3,526	4,463	3,677	4,525	2,368	5,563	4,728
C	3,283	2,074	4,666	2,506	6,112	2,112	9,696	5,664
D	2,828	1,656	5,832	3,816	7,990	6,768	11,040	7,776
E	.....	.....	.....	.....	.....	.....	2,016	1,248
F	.....	.....	.....	.....	.....	.....	2,568	1,728
G	.....	.....	.....	.....	.....	.....	1,843	355
H	.....	.....	5,882	3,633	6,041	1,384	5,700	3,000
I	.....	.....	.....	.....	.....	.....	28,000	14,000
J	.....	.....	.....	.....	.....	.....	29,500	30,500
K	.....	.....	.....	.....	.....	.....	113,700	87,000
	12,507	7,650	23,171	15,192	26,704	13,796	221,618	157,055
	Diversity factor = $\frac{7,650}{12,507} = 0.612$		Diversity factor = $\frac{15,192}{23,171} = 0.656$		Diversity factor = $\frac{13,796}{26,704} = 0.516$		Diversity factor = $\frac{157,055}{221,618} = 0.708$	

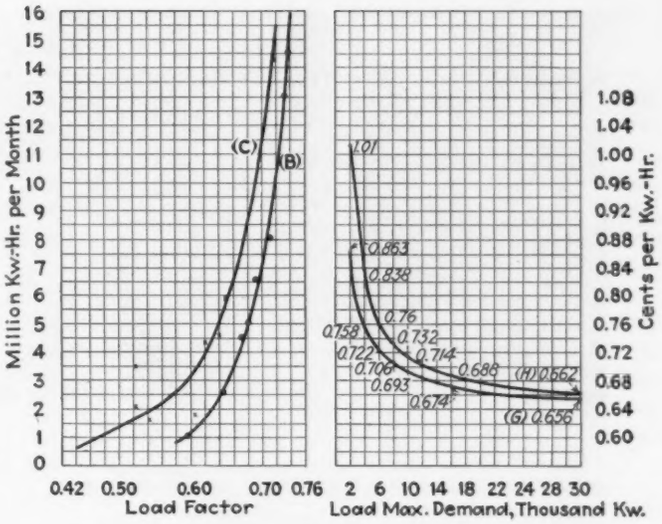
shows maximum load, minimum demand and average load in cubic feet per 24 hours for the twelve months of the year, approximating the conditions in the greater Chicago district a few years ago. From these data the annual gas load factor is approximately 0.75.

If one were called upon to devise "ideal" means of supplying energy in manufactured gas, either in one or a few very large plants, he would have several ways to meet these conditions. The requirements could be covered entirely by coke oven gas. This procedure evidently lacks flexibility of operation and has the disadvantage of large sale of coke. The average annual demand could be delivered by coke oven gas and the balance by carbureted water gas. However, the minimum daily output of the coke ovens would be only about 67 per cent of the oven capacity. Also, the utilization of the water gas plant would be low, entailing high cost of the gas from such a plant. The rating of the coke ovens could be so selected as to correspond with the average load of a summer month. However, this selection would have in lesser degree the same drawbacks as the preceding method. Favorable conditions result if the coke oven plant has an output corresponding with the load about half way between the average daily load of a summer month and the minimum daily load of such a month. Here the output of the coke oven plant would have to be reduced somewhat, but very seldom, and the water gas plant would show a good utilization.



Load characteristics of greater Chicago gas utilities

The curves of gas volume and demands are of actual operation. Below them is shown how the load they represent might be cared for by manufactured gas supplied by a hypothetical "ideal" combination of production methods.

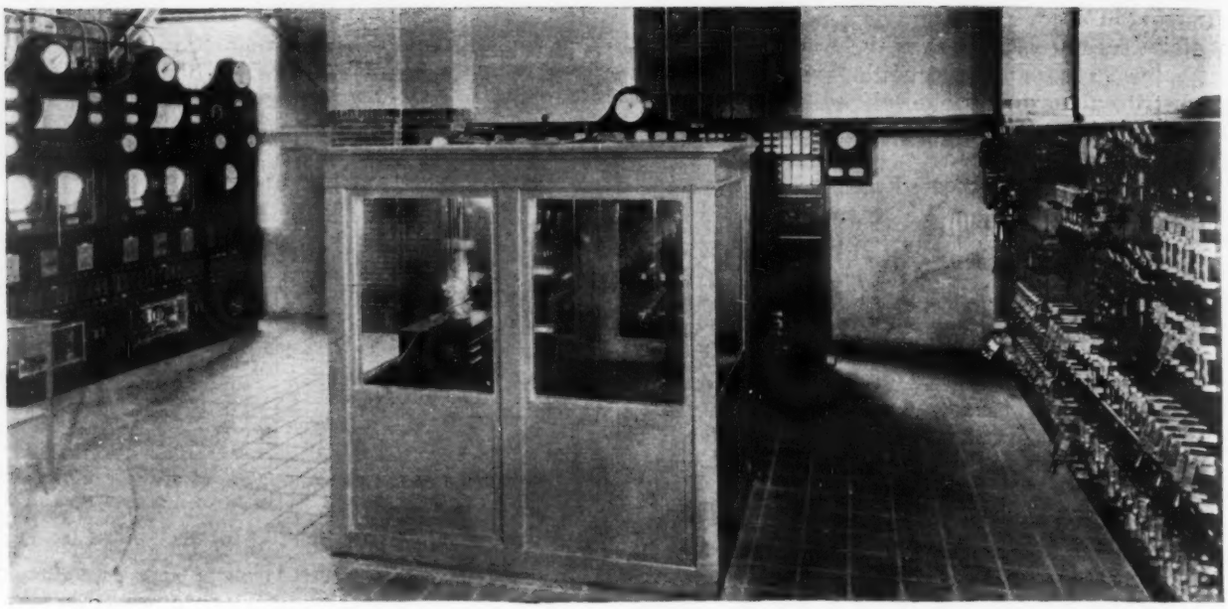


Cost of electricity related to steel plant loads

Curve *B* load factor of steel plants at a good rate of operation as function of energy in kilowatt-hours per month, based on monthly values. Curve *C* load factor of steel plants at a good rate of operation as function of energy in kilowatt-hours per month, based on average values. Curve *G* price of 1 kw.-hr. in Chicago as function of maximum load in kilowatts for steel plant with load factor based on monthly values (Curve *B*). Curve *H* price of 1 kw.-hr. in Chicago as function of maximum load in kilowatts for steel plant with load factor based on average values (Curve *C*).
These curves are based on rates of the Commonwealth Edison Company, but are rate exhibits only as referred to certain conditions of steel plant maximum demand and rate of steel production as discussed in the exposition presented here.

On the basis of such a selection of rating of plants and assuming ideal facilities and average investment costs and fair revenue from by-products, it is readily calculated that the surplus coke oven gas would probably require an expenditure of about 20 cents per 1,000 cu.ft., equivalent to 35.6 cents per 1,000,000 B.t.u. Since the coke ovens would be underfired with producer gas, the coke oven gas liberated thereby probably would cost, calculated, about 28 to 29 cents per 1,000 cu.ft., corresponding to about 51 cents per 1,000,000 B.t.u. A modern carbureted water gas plant would produce 1,000 cu.ft. of gas under such conditions at about 47 to 48 cents, equivalent to about 85 cents per 1,000,000 B.t.u. These calculated costs of the hypothetical method of supplying city gas under such load conditions brings out forcibly the importance of the load factor and also the fact that the value of gas that is supplied from other sources depends to a very considerable extent on the rate of its delivery.

In any steel plant operation both gas and electricity are of paramount importance. Gases of various heat values are available as by-products, as is waste heat also. However, surpluses or deficits of gas or electricity or both exist at practically all times. Therefore, it is reasonable to conclude that an energy interflow arrangement between the steel plant and the gas and electric utilities offers opportunities of economy to all three parties. This theme will be developed further in articles to appear in early issues of the ELECTRICAL WORLD.



Centralized Controls Simplify Station Operation

By E. M. GILBERT
Chief Engineer
W. S. Barstow & Company, Inc., New York

A central grouping of controls for transmission circuits, generators and essential electrically driven plant auxiliaries facilitates operation at the 55,000-kw. Gilbert station of the New Jersey Power & Light Company, part of the Associated Gas & Electric System.

Control switchboards are on the main operating floor level, in full view of both boiler and turbine equipment. There is no wall between the boiler and turbine rooms. This arrangement puts the boiler control, switchboard and turbine operators close to one another, making it easy for each to become acquainted with the others' duties and facilitating co-ordination in operation. This arrangement also makes it possible for one operator to relieve another for short periods, thus cutting down the need for assistant operators.

A switchboard, from which the essential boiler and steam auxiliaries are controlled, at the left in the accompanying figure, accommodates the indicating and graphic instruments, control and automatic apparatus for two boilers of 1,400 lb. pressure and a smaller panel for the master control equipment serving plant auxiliaries which are common to both boilers.

Each boiler-control panel carries instruments indicating water level, fan loads and fuel-feeder position, as well as graphic chart instruments for recording flow of steam, air and water, steam superheat and reheat temperature. At a convenient operating height below the indicating and graphic instruments are automatic control drums and manual control buttons for forced and induced draft fans, fuel feeders, dampers and steam valves. There are also lamps to indicate normal and abnormal conditions of equipment not directly under control of the boiler operator, such as the level of coal in pulverized-fuel bins.

The master control panel on the extreme right of this switchboard supports the indicating and graphic instruments for total boiler-feed water and total steam flow. Manual control buttons for steam valves and boiler-feed pumps with auxiliaries, as well as master automatic-control drums and relays for fuel and draft and boiler-feed-water header pressure, are placed on the panel in positions similar to the control apparatus on the boiler control panel. An added feature on the master control panel is the duplicate governor control for the high-pressure and low-pressure turbo-generator and a meter indicating total kilowatts.

The operator of the boiler control has available all the operating information and control facilities for efficient performance of his duties. He is also able to co-operate closely with the operator of the electrical switchboard (behind the telephone booth). This main electrical control switchboard is composed of six 24-in. panels. The two right-hand panels are reserved for 24 circuits of "miniature remote control" for the 114-kv. and 33-kv. transmission substations. The other panels include all the control and graphic indicating and integrating instruments and protective relays for the main-station service circuits, high- and low-pressure turbo-units and low-tension switchboard for the main power transformer bank. All of the control equipment mounted on these boards is of standard type with the exception of "miniature remote control" for the high-tension substations, one panel of which may be seen to the right of the operator's booth.

The operator of this switchboard has control not only of the main power supply circuits, but also of the main circuit feeding the miscellaneous direct-current and alternating-current power and light centers of distribution. The switchboard on the extreme right contains the circuit-interrupting, control and indicating apparatus for these feed sources for miscellaneous direct current and alternating current for distribution centers. One of the main automatic features on the switchboard is the change-over equipment for keeping the main steam valve

operating bus energized regardless of whether or not the main station service system is energized. Normally this bus is energized from the direct-current bus with a 250-volt fuel-feeder motor-generator, through a two-pole, 300-amp. contactor, mechanically and electrically interlocked with a second such contactor which connects the station battery to the bus in event of failure of potential of the normal source. This automatic equipment insures that energy will be always available for valve operation during emergencies.

Indicating switchboards for the steam end of the turbo-units are installed on the same elevation at a point not far from the main switchboard and close to the turbines. The turbine operator is, therefore, within calling distance of the operators both of the boiler control and of the main switchboard and can co-operate with them in the normal operation of equipment under his care.

Operation during the past year has justified this arrangement of control by reducing the personnel necessary to run this plant efficiently during both normal and emergency conditions. The men are familiar not only with their own duties but, in a general way, with the duties of their associates also. This fact is noticeably evident in the quick manner in which they clear up trouble in emergencies.

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Underground vs. Overhead Distribution for Residential Areas

Increasing congestion in streets and alleys, unsightly appearance of pole lines, difficulties in obtaining tree-trimming permits, improved operating characteristics by reason of greater reliability, municipal orders and public policy are factors listed by the underground systems committee, Electric Section, Wisconsin Utilities Association, as tending toward future large increases in underground distribution in residential areas.

In the report of the committee read by its chairman, G. S. Meader, Northern States Power Company, at a recent convention of the section, there was included tabulated estimates of costs for underground and overhead service to a given district under three supply system conditions. For convenience of reproduction the six tables of the report are combined into the single table which accompanies this article. The factor tending toward increased underground distribution recited in the first sentence of this paragraph, when taken in conjunction with the cost ratios presented at the bottom of the table, bear out the opinion of the committee that "the utilities will undoubtedly in the not-too-distant future be called upon to develop a relatively inexpensive underground distribution system for residential areas which have small load densities per block."

The distribution area on which the estimated costs are based is a portion of a suburban real estate development in Minneapolis, Minn., a restricted, exclusive residential project of rather better than medium class. The area selected includes eight square blocks, of which four lie on each side of the street along which runs the main primary branch. Primary taps are taken off this street primary and run along the backs of the lot line about half the length of each block. The bases of the estimate include provisions for expansion to take care of future load growth, present demand of 550 watts per customer, voltage regulation in conformance with the Wisconsin electrical code, average length of services 80 ft. with No. 6 copper, two iron pipes under all streets crossed and primary and secondary copper as set forth in the tabulation.

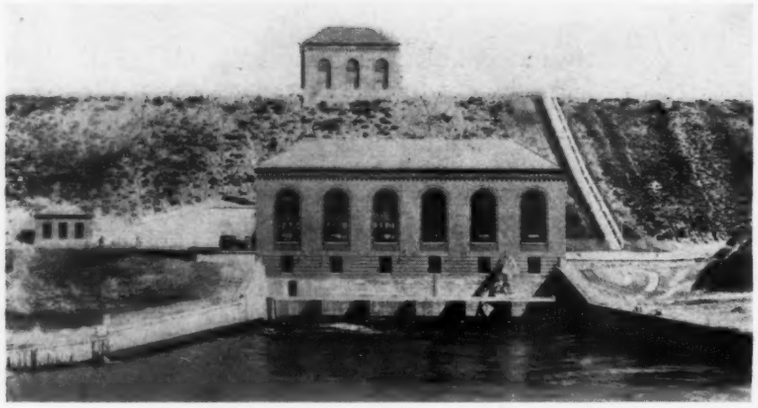
The ratio of cost between overhead and underground construction indicates very clearly that if the utilities are to embark upon a program of underground distribution for light load areas there will have to be a considerable revision of equipment and practices in underground distribution if the cost is not to have an adverse effect on electrical utility financing and earnings.

Comparative Costs of Overhead and Underground Constructions for Isolated, Isolated Neutral and Common Neutral Systems*

	Isolated System		Isolated Neutral System		Common Neutral System	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Overhead Construction						
40-ft. poles	38	$645	38	$645	38	$645
35-ft. poles	19	265	19	265	19	265
Guys	9	65	9	65	9	65
Crossarms, racks, etc	.....	265	.....	130	.....	145
No. 2 weatherproof wire, lb.	3,000	600	3,000	600	2,700	540
No. 1/0 weatherproof wire, lb.	7,300	1,460	7,300	1,460	7,300	1,460
No. 6 weatherproof wire, lb.	1,800	360	1,800	360	900	180
25-kva. transformers	8	1,750	8	1,750	8	1,750
Arresters and cutouts	16	210	16	210	8	105
Services-3-wire No. 6 weatherproof	176	1,410	176	1,410	176	1,410
Section fuses	14	70	14	70	14	70
Grounds	24	120	24	120	24	120
Total material		$7,220		$7,085		$6,755
Labor, insurance and transportation		2,185		2,090		1,770
Sub-totals		$9,405		$9,175		$8,525
Engineering, supervision, etc., (10%)		940		917		852
Total costs		$10,345		$10,092		$9,377
Underground Construction						
Manholes (4 ft. x 5 ft.)	12	$2,400	12	$2,400	12	$2,400
2-cond. No. 2 5,000-volt cable, ft.	1,400	840	1,400	840		
1-cond. No. 2					1,400	630
2-cond. No. 6 5,000-volt cable, ft.	4,600	2,070	4,600	2,070		
1-cond. No. 6					4,600	1,890
3-cond. (1 No. 2, 2 No. 1/0) 600-volt cable, ft	7,300	2,600	7,300	2,600	7,300	2,600
3-cond. No. 6 600-volt cable, ft.	15,000	2,500	15,000	2,500	15,000	2,500
3-in. iron pipe, ft	960	480	960	480	960	480
25-kva. transformers	8	1,750	8	1,750	8	1,750
D. & W. oil cutouts	38	1,560	19	780	19	780
Grounds	8	110	8	110	8	110
Total material		14,310		13,530		13,140
Labor, insurance and transportation		9,000		8,900		8,850
Sub-totals		23,310		22,430		21,990
Engineering, supervision, etc. (10%)		2,331		2,243		2,199
Total costs		25,641		24,673		24,189
Summary						
Total costs for overhead construction		$10,345		$10,092		$9,377
Total costs for underground construction		25,641		24,673		24,189
Ratios of underground to overhead construction costs		2.48		2.45		2.56

*Systems referred to are: Isolated, 2,300-volt, 2-wire from a three-phase system with no neutral; isolated neutral, 2,300-volt, 2-wire from a three-phase system with neutral grounded at station only; common neutral, 2,300-volt, 2-wire from a three-phase system with neutral continuous through primary and secondary and continuously grounded.

Hardy Dam Goes on the Line

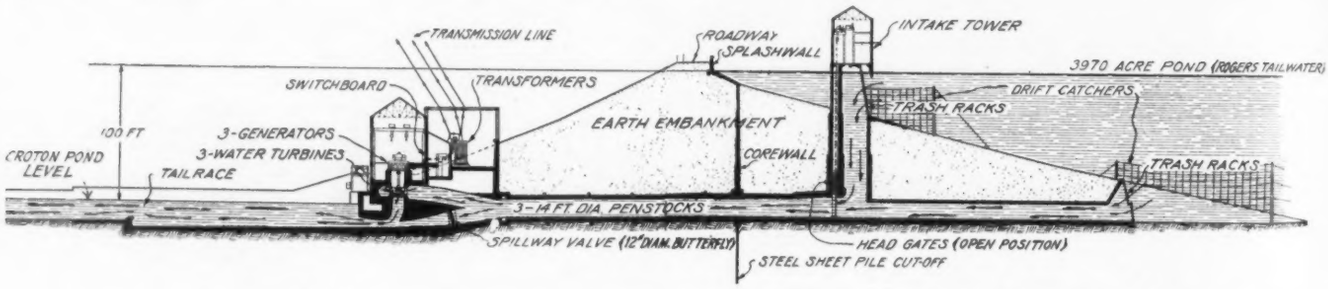


Headworks and power house are separate

The power house location is below the embankment section and consequently its construction, aside from the substation and tailrace, did not have to be included in the dam-building program, which was carried forward as season and water conditions permitted best construction economy, leaving the station to be built on its own independent schedule.

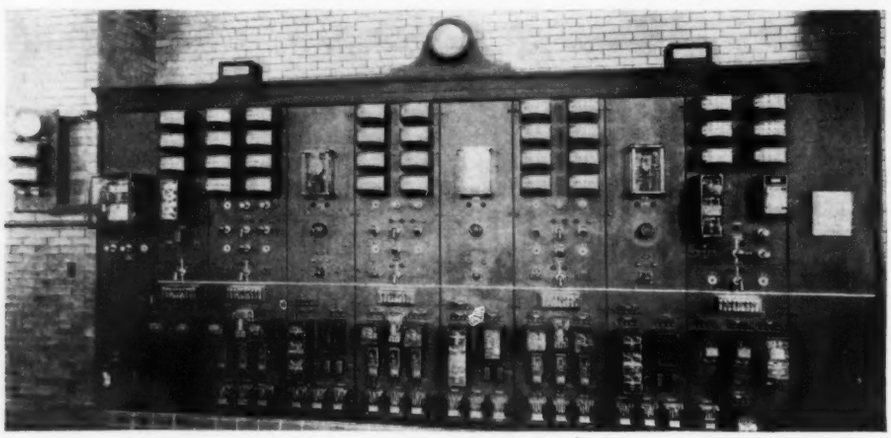
ENERGY averaging 80,000,000 kw.-hr. yearly will be fed into the Consumers Power system from its recently completed hydro development. Hardy Dam, which will operate normally as a peak-load plant. Hardy Dam is located on the Muskegon River between the present Rogers and Croton plants. The entire fall in the river between these two plants is utilized, with the Rogers plant discharging water directly into the Hardy pond and Hardy discharging into the Croton pond. After water has been used at Hardy it is again used at two downstream plants—Croton and Newaygo.

One of the features of Hardy Dam is its large water storage capacity of almost 4,000 acres, which is more than twice the size of any other storage reservoir on the Consumers Power Company system. The water in the top foot of this pond is capable of developing approximately 300,000 kw.-hr. at Hardy and 200,000 kw.-hr. at the two downstream plants, Croton and Newaygo. A 12-ft. draw down of Hardy pond will supply a 5,000,000 kw.-hr. total at Hardy, Croton and Newaygo.



Earth dam holds 100 ft. head

A final settlement of only a small fraction of an inch when the pond was filled answers criticism of earth-fill construction by engineers not experienced with Michigan conditions. This type of dam has not heretofore been built under these conditions and of this magnitude. Higher earth embankments have been built, but either on rock foundations or separate from power house and penstock structures. As far as known no embankment of this height has been built on earth foundation and containing through penstocks and power house located as shown.

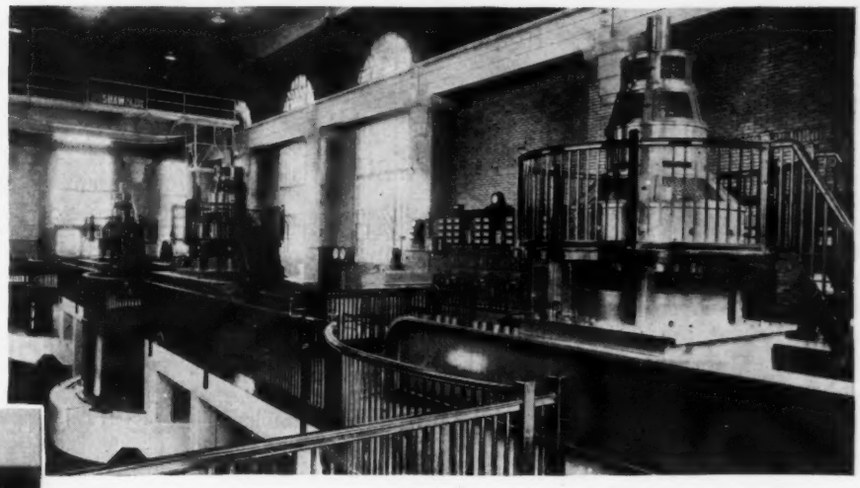


Complete automatic control

The plant, including intake tower, has one operator per shift. Ordinarily he merely moves control switches to "start" and "stop" positions for each unit, but he can operate controls manually if anything goes wrong. Synchronizing and all load and voltage controls are fully automatic.

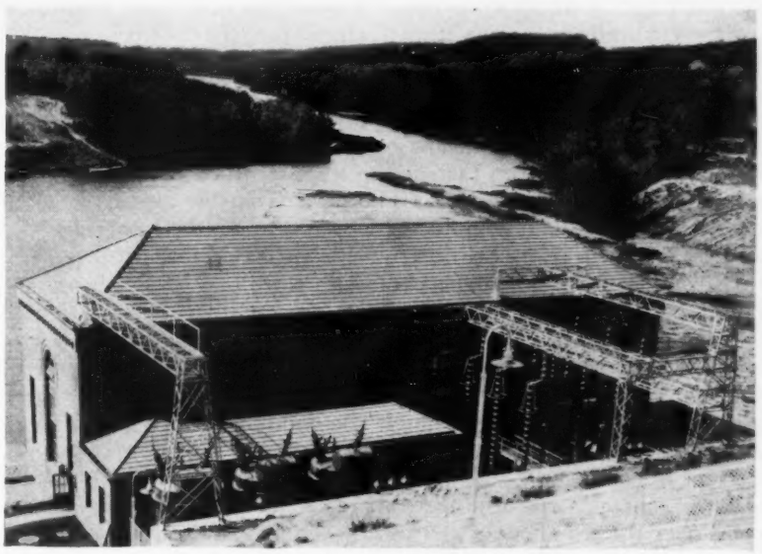
Inside the station

Three identical 10,000-kw., 60-cycle vertical units are supplied with water through a separate 14-ft. penstock controlled by a roller gate at intake tower. I. P. Morris turbines, with steel scroll cases incased in reinforced concrete, and Woodward governors drive the General Electric generators with overhead thrust and guide bearings carried on welded structural steel stators. Each generator has a completely inclosed air duct and water-tube cooling condenser, all located below the operating floor, which is at exciter level.



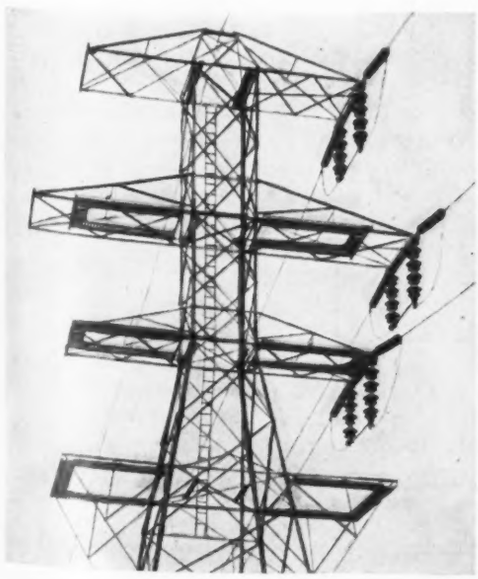
From the highway on top of the dam

The output is stepped up to 140 kv. from the generator voltage of 7,500 in three Allis-Chalmers 12,500-kva. transformers and passes to the transmission line through General Electric FHKO breakers rated at 400 amp. Public relations are mightily helped when Mr. Citizen can stop his car on a highway on the top of a dam and show his family a river vista like this over the roof of a power house.



If the unprecedented happens

There is no record of floodwater in the Muskegon River capable of overtopping Hardy Dam, nor apparently is such a phenomenon probable with local soil conditions. But in case the unprecedented thing does happen Hardy will be safe. At the west end of the dam is an emergency overflow of twice the operating spillway capacity. The overflow weir at the emergency spillway intake is built of short concrete sections of varying thickness and stability, designed to overturn and wash away progressively as the pond level rises.



Tower types

Power is brought into the system from Hardy Dam over a 48-mile line to Grand Rapids. The single ground wire is $\frac{3}{8}$-in., seven-strand galvanized cable and the conductors are No. 3/0 seven-strand copper. Normal spans are 740 ft. Special efforts were made to keep conductor heights as low as possible and to assure low resistance grounds at tower footings. Tower types shown are: Left, dead-end switch tower; right, 12 to 45-deg. angle tower.

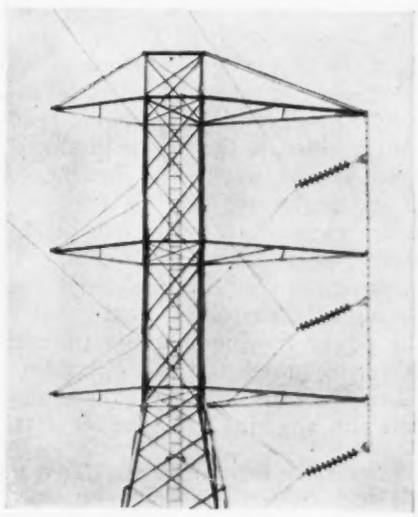


Photo-Electric Telemeters Used on Southern System

By A.J. JOHNSTON* and T.A. BUSBY†

An installation of the new torque-balance telemeter developed by the General Electric Company was recently made by the South Carolina Power Company at one of its tie-in substations. This will provide the load dispatcher at the Charlotte Street steam plant with a continuous reading of the power flowing through the substation, 3 miles distant. The installation consists of a standard indicating instrument located at the Charlotte Street steam plant, a solid metallic circuit between the steam plant and the tie-in station and a torque-balance telemeter located at the tie-in station. The indicating instrument at the steam plant is a standard zero center direct-current milliammeter and the metallic circuit is a pair of conductors in a lead sheath cable of the telephone type. As the torque-balance telemeter is a new device some details of its application on this system may be of interest. The telemeter proper consists of a standard polyphase wattmeter element; a standard direct-current milliammeter element, two amplifier tubes, two photo-electric tubes, a standard automobile headlight bulb, lens, instrument mirror and a transformer for the power supply.

The torsion springs of both instrument elements are replaced by conducting spirals. The two meter elements are coupled together by means of a universal joint and the instrument mirror is fastened to a shaft which forms a part of this universal joint. The light from the automobile headlight bulb is condensed by means of the lens and is reflected upon the instrument mirror, which in turn reflects the light to the photo-electric tubes. Each photo-electric tube is associated with an amplifier tube, and these tubes are so connected that, when more current is passing through the first tube than through the second tube, current will flow in the milliammeter element, over the telephone wires and through the indicating instrument at the steam plant in one direction. When more current is passing through the second tube than through the first, current will flow through the milliammeter element over the telephone wires and through the indicating instrument in the opposite direction.

The amount of current passed through the tubes and the direction of this current are dependent primarily upon the proportional amount of light falling on the two photo-electric tubes. The circuit is so arranged that the torque produced by the current from the tubes is always in opposition to the torque produced by the power measured by the wattmeter element. Therefore, the only force, neglecting bearing friction, opposing the wattmeter element is the torque produced by the milliammeter or restraining element. The current flowing through the restraining element over the line wires and through the indicating instrument is a true measure of the power flowing in the wattmeter circuit. The only power required for the operation of the telemeter is taken from an ordinary alternating-current lighting circuit and amounts to about 50 watts.

The indicating instrument at the Charlotte Street steam plant will actually follow load changes as quickly as a standard wattmeter connected in the circuit at the tie-in station. Thus, the dispatcher is able to observe a power swing of very short duration. Another feature of the telemeter is that the volt-ampere burden imposed on the instrument transformers is very low, being only that required by a standard indicating wattmeter.

*Switchgear engineer General Electric Company, Philadelphia.
†Meter engineer South Carolina Power Company, Charleston.

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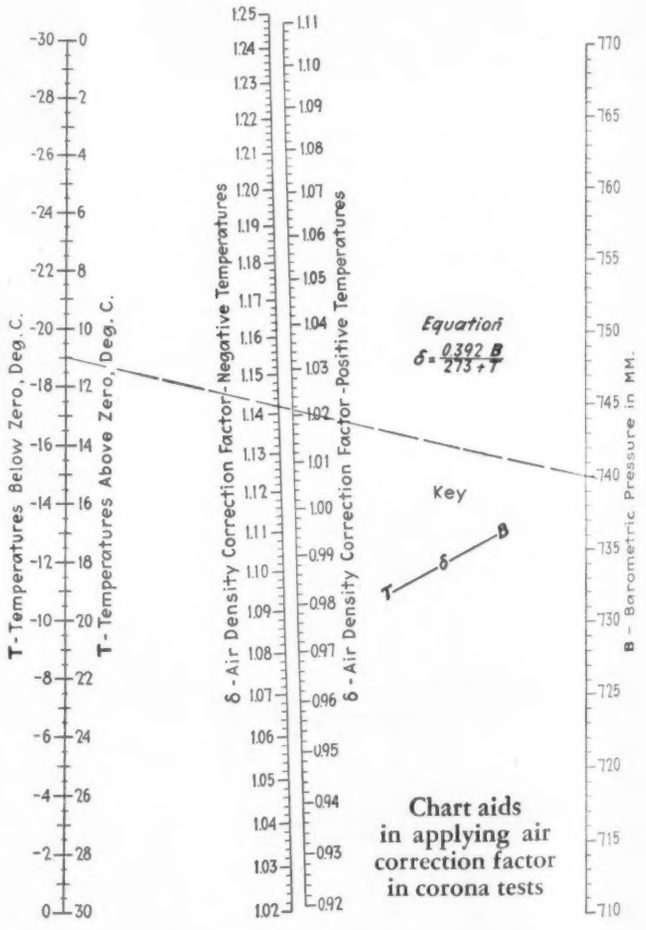
Chart for Air Density Correction Factor

By J. N. ARNOLD

Instructor, Purdue University, Lafayette, Ind.

F. W. Peek's formulas for disruptive critical voltage and power loss in connection with corona discharges contain an air density correction factor, δ. The same factor is involved in the correction of sphere-gap measurements. An alignment chart has proved useful in the high-voltage laboratory at Purdue University. With 10-in. scales it affords one more significant figure than is given by the ordinary slide rule.


T - Temperatures Below Zero, Deg. C.
T - Temperatures Above Zero, Deg. C.
δ - Air Density Correction Factor - Negative Temperatures
δ - Air Density Correction Factor - Positive Temperatures
B - Barometric Pressure in MM.
Equation
δ = 0.392 B / 273 + T
Key
B
δ
T
Chart aids in applying air correction factor in corona tests

Example: To determine air density correction factor for a barometric pressure of 740 mm. and a temperature of 11 deg. C. draw a straight line through 740 on the B scale and + 11 on the T scale. Read δ at 1.021 on the δ scale for positive temperatures.

Legislation vs. Co-operation in Utility Appliance Selling

By WILLIAM H. HODGE*
Vice-President and Manager Sales and Advertising
Byllesby Engineering & Management Corporation

LEGISLATION to prohibit utility companies selling electric and gas household appliances is being advocated in many, if not all, states of the Union. This issue is opposed by the utilities on the ground that maximum public interest will be best served by means of co-operative planning and action among all interested retail agencies, in a manner that will divert a constantly increasing proportion of the business to non-utility outlets.

Where well-founded criticism has existed the causes could be removed through direct conference in most cases, were it not for the interjection of some misinformed or self-interested individual. Each locality should handle and settle its own difficulties to its own satisfaction.

After all, there is a public without which neither the utilities nor the merchants and dealers could exist. Not yet in any considerable locality has the question of utility merchandising been thoroughly debated before the court of public opinion. Not yet has the public either been seriously interested or thoroughly informed on the points at issue or awakened to how it is affected. In the two states which have adopted anti-utility merchandising laws —Kansas and Oklahoma—much was heard from the proponents, but little was said by the utilities.

How can merchants benefit?

It is but natural that with the growth of sales of electrical appliances during the last few years merchants and dealers should wish to attract a larger proportion of the business to their stores. The utilities have no quarrel with this ambition. The greater the number of successful retail outlets for high quality appliances the better it is for the power and gas businesses. It does not follow, however, that the merchant will receive the appliance business previously done by the utility, or even as much as he has received before, if the utility steps out. Reliable information from the anti-utility merchandisinig states of Oklahoma and Kansas indicates that the independent merchant has not as yet greatly improved his position.

Remove the force and stimulus of utility merchandising and you delete something in a community which apparently cannot be substituted at present from other sources.

Electric and gas services cannot be consummated without the operation of appliances by the consumer. It is just as logical for the utility to install electric appliances as it is for the telephone company to install telephone instruments in order to make its service operative. However, the first is portable and subject to diverse treatment at the will of the user, and the other practically is not. One is comparatively inexpensive; the other calls for considerable expenditures. Except for these vital differences there is little doubt but that the introduction of electric service would have followed the same outline as the telephone; that is, the utility would own all the appliances and have to provide the entire investment. Sometimes courts have ruled and franchises contained the provision that it is the obligation and duty of the utility to make proper appliances available for the purchase of the service consumer.

Quality, safety, rate reductions

The utilities have a tremendous and rightful interest in the quality and efficiency of the appliances in the homes of their customers. If the appliance does not function properly the best standards of electric or gas service are powerless to make a satisfied user, the appliance is discarded and the business is lost. A major reason why the utilities wish to retain a degree of appliance distribution is to maintain the most effective means at their disposal to keep up the quality and safety standards of these devices.

Practically all utilities would prefer not to deal in appliances if the public can be adequately served otherwise. But such a general policy will inevitably slow down the pace of development, depreciate the quality and safety of appliances, lessen the building up of residential and rural service volume, and thus delay future rate reductions. Particularly is this true in the towns and rural districts, where many times the utility is the only possible agency for distribution.

Nevertheless the utility has too much at stake as an industry to resist the present movement for anti-merchandising legislation beyond a certain point. It cannot afford to jeopardize unduly public good will, franchise requirements and the general sufferance allowing it to exist. In the event of prohibitive legislation it simply must do the best it can by indirect methods, in all probability considerably more expensive than those now employed.

The argument that the apparent losses in utility merchandising represent an unfair burden—or any burden —on the service users cannot be sustained by analysis as a general rule. The practice of courts and commissions, with few exceptions, has been, when fixing rates, to deny the inclusion of actual merchandising losses in operating expenses. As a matter of fact, these apparent

*Excerpts from address before Great Lakes division, N.E.L.A.

What 68 Kansas Editors Think of Anti-Merchandising Law

The following comments are based on a ballot vote taken at the recent meeting of the Kansas Press Association

Conway Springs *Star*—Bad. Sure cuts down our advertising.

Glasco *Sun*—Bad.

Hays *Daily News*—Hurts advertising tremendously as a whole for Kansas newspapers.

Larned *News*—Unfair.

Anthony *Republican-Bulletin*—Bad. Both from standpoint of curtailed service and efficient merchandising.

Burlington *Republican*—The law is as bad as they make them and has few merits of any kind.

Douglas County *Republican*—Bad, both from the standpoint of service to the public and revenue to the publisher.

Gerard *Press*—Bad for utilities, public and industry, as well as for newspapers.

Times-Star—Bad, favor its repeal.

Whitewater *Independent*—No good. Much harm.

Kinsley *Mercury*—Worse than it appeared at first. Should be repealed.

Chase County *News*—Has caused inconvenience to public and increased unemployment.

Abilene *Chronicle*—Law does not benefit the majority of people as local merchants do not render service or sale as did utilities.

Lakin *Independent*—The law has not been of practical benefit but a backward step.

Plains *Journal*—Bad law. Has not helped local dealer as anticipated.

Arkansas City *Traveler*—Bad.

Valley Center *Index*—Absolutely damn rotten.

Moundridge *Journal*—Bad.

Heaton *Gazette*—Bad.

Clearwater *News*—A silly law of no benefit to any one and detrimental to users of appliances.

Olathe *Mirror*—Repeal of the present law would benefit a larger number of people. It is bad.

Lindsborg *Progress*—Bad, many towns affected and number of people thrown out of employment.

Scott City *News-Chronicle*—Think the law is class legislation and therefore unjust.

Haddam *Clipper*—Bad.

Linn *Record*—Rotten.

Burr Oak *Herald*—Assinine and highly detrimental to the state welfare.

Haven *Journal*—Bad, cuts out business for all.

Leon *News*—Bad, very bad—loss of rent, lack of employment, loss of advertising and no good to any one.

Onega *Herald*—Should be repealed by all means.

Caldwell *Messenger*—Unfair and inconvenient to public.

Clay Center *Dispatch*—I believe the law should be repealed soon as possible.

Clay Center *Times*—Bad. No good comes from it at all.

Mulvane *News*—It has accomplished no good. Let's have it repealed.

Kansas *Official*, Tokepa—Bad, ought to be repealed.

Newton *Journal*—Bad.

Pretty Prairie *Times*—Most deplorable.

Kansas *Facts*—Repeal that law.

Pittsburgh *Advertiser*—A vicious law which should be repealed. Instead of helping local business it has hurt it.

Minneapolis *Messenger*—Have been unable to see a single benefit in this law. Am decidedly in favor of its repeal.

Peabody *Gazette-Herald*—Very bad.

Scandia *Journal*—Repeal it. We have had no service on utility equipment since local dealers took over the job.

Coffeyville *Journal*—Bad.

Kansas City *Kansan*—Let utilities merchandise.

Horton *Headlight-Commercial*—Bad. Local dealers do not push sales and do not have means of financing credit sales. I do not believe the law creates business for small independent dealers.

Ashland *Clipper*—Bad; just another fool regulation by government in unfair restraint of trade.

Washington *Register*—Bad; has resulted in much inconvenience to public in smaller towns.

Medicine Lodge *Index*—Bad. Limits prompt repair of appliances, lessens their use, destroys business and labor.

St. John *News*—Bad.

Tri-State *News*—Unfair to the public and discriminatory. Should be repealed.

Herrington *Times*—Law an injustice. Put a lot of men out of work.

Eskridge *Independent*—Bad, very bad, should be repealed.

Osage City *Free Press*—Bad. Ought to be repealed.

Enterprise—Bad. Repeal it.

Cheney *Sentinel*—Bad; takes away new and old business that has not returned.

Fredonia *Citizen*—Bad.

Alma *Enterprise*—Deprives people of necessary service and its repeal is generally demanded.

Emporia *Times*—Until the law stopped it one of our best features of the town was utility merchandising.

Wellington *Daily News*—I think the law good and in the interests of good government.

Hope *Dispatch*—In plain words, a rotten law.

Newton *Kansan*—Unfair.

Eldorado *Times*—Bad.

Stafford *Courier*—Law should be repealed.

Lyons *News*—Bad.

Great Bend *Tribune*—Mighty vicious law. Injures public through poor service and higher prices.

Concordia *Blade-Empire*—Very bad and injurious, puts a crimp in small community.

Hutchison *News*—Poor law.

Ellis *Review*—Bad.

Holton *Recorder*—Bad. It deprives towns of needed service, causes empty store rooms and unemployment.

losses usually are partly bookkeeping allocations and are made up of three principal items, the first of which is regarded as desirable by all concerned. These items cover the following expenses:

1. Promotional or development expenses for those appliances not yet sufficiently accepted by the public to avoid selling costs exceeding the margin between wholesale and retail prices.

2. Purchase and warehouse expense, display room rents and other overhead on an arbitrary or pro rata basis.

3. Interest on the capital employed in merchandising operations.

Utility companies under Byllesby management for years have kept separate merchandising accounts, with all conceivable expense included. They include liberal purchase and warehouse expense allocations, although the warehouse and personnel have to be maintained in any event for construction material. Most of these properties have apparent red ink merchandising balances, but if they quit merchandising a considerable part of the expenses now set up as red ink will remain and merely be shifted over to operating expenses, because offices and warehouses and most of their personnel must still be retained to carry on the main business. Whether or not they merchandise, promotional or development expenses will remain if the public is to be fully served, and probably will be more than before, and these items will be permitted by all laws and regulatory commissions as operating expenses.

When the Oklahoma Gas & Electric Company was legislated out of the appliance business last July it immediately organized a sales development department to co-operate with merchants and dealers toward keeping

up the growth of residential and rural electricity usage. The appropriation for this department is just about the same amount as was the apparent merchandising red-ink balance in a normal year, including 6 per cent interest. As an alleged merchandising loss the expenditure was severely criticised. As a development expense to help other people sell appliances it seems to be cordially approved.

Disregarding interest, if the apparent merchandising loss were evenly apportioned among the 100,000 or so residential customers of this particular company, it would amount to about 60 cents a year each; that is, it would have meant that much to the average annual residential bill if it had been charged up in this manner, which was not the case, as a matter of fact. But, owing to the growth of residential business, as the result of combined merchandising effort on the part of the company, merchants and dealers, the Oklahoma company has been reducing rates rapidly during the past few years and the customer profited to an extent many times 60 cents a year or 5 cents a month. Last year alone his annual bill was reduced more than $4 and expenses equivalent to the alleged former red ink balance are still being carried by the company.

Kansas editors ask repeal

Let Kansas citizens speak of the actual working out of the anti-utility merchandising law in that state. On January 16 the Kansas Press Association (attended by about 250 editors and publishers representing the daily and weekly newspapers of the state—men who are close to the people and know public sentiment in their own communities) adopted the following resolution, it was reported, by a nearly unanimous vote:

> On the grounds of depriving cities and towns of adequate service and contributing to empty store rooms and unemployment we urge the repeal of the law known as the "utility merchandising act," believing its operation has been a detriment rather than a benefit to communities.

This resolution was preceded by a speech by Earl Fickertt, editor of the Peabody *Gazette-Herald*, retiring secretary and member of the executive committee, who said:

> When House bill No. 144, or what is known as the utility merchandising law, went into effect, last August 1, two of the best stores in Peabody were forced out of business, and at the same time two of the best advertisers in town were eliminated.
>
> This will be nothing new to you because the same thing happened in your town as did in mine.
>
> During 1930 the electric and gas utility companies spent more than a thousand dollars for advertising space in my paper. During 1931, prior to August 1, they spent $400 for space, and since August 1 both of them have used a grand total of $42.50 worth of space. This loss of a thousand dollars per year is total, because none of the other merchants now handling merchandise formerly sold by the utilities have increased their advertising budgets by reason of taking on the added lines.
>
> I have it from a reliable authority that the electric utilities alone used advertising space in Kansas newspapers during 1930 to the extent of $250,000, to which could probably be added another $100,000 of factory and distributor advertising that is not now being used, while in other states where they do not have a law of this nature this kind of advertising is about 85 per cent normal.
>
> The result is a distinct slump in the sale of this kind of merchandise in Kansas. One utility company tells me that during 1930 they sold over 400 electric ranges in their territory, and in this same territory since last August 1 five electric ranges have been sold by dealers now handling their sale.
>
> Who has benefited by the passage of the law? So far as I can learn, the chain stores are now selling 48 per cent of the appliances, department stores 15 per cent, specialty stores 12 per cent, contractors 15 per cent, battery and tire dealers 8 per cent, hardware stores 1 per cent and furniture dealers 1 per cent. The business formerly held in the smaller towns by the utility companies is now going largely to the chain and department stores of the larger cities.
>
> In my estimation this law has destroyed a large volume of business; it has thrown people out of employment; probably more than 200 in Kansas; it has closed up stores; it has deprived Kansas newspapers of more than $300,000 in advertising revenue, and no one in Kansas has benefited to any material extent.
>
> I think it time the Kansas Press Association should take a definite stand on this matter and urge the repeal of the law by the Kansas Legislature at its first session.

Hard times responsible for agitation

Recently a Texas court ruled that the San Antonio Public Service Company could not merchandise on the ground that such activities are beyond the scope of its charter. Commenting, the Chicago *Journal of Commerce* said:

> If the company's charter did not provide for the selling of appliances, certainly it should not sell them. But that is not any reason why other utilities in Texas should not continue to sell appliances, if their charters do allow them this right. And it is no reason at all for cleaving the appliance business from the utilities which instituted it, developed it, and whose money, in many cases, brought the appliances into existence. This is one of the smoldering ill-wills that hard times have brought to a head.
>
> The utilities transact 30 per cent of the appliance business in the country—a business built up by themselves for extending their service. They believe that this ratio will eventually decline to 20 per cent, but they maintain that complete withdrawal from the business would cause a wholesale letdown in the sales of appliances. Consequently the 100 per cent capture of the market —which belongs to the utilities to begin with—by the protesting merchants and contractors would be less remunerative to the merchants than the 70 per cent, with the utilities getting the remaining 30 per cent and supplying the distributive force upon which the appliance business is built.

Results of Oklahoma sales drive

It may be well to inquire further into what actually happens when the utilities are forced out of merchandising. I have already stated that the Oklahoma Gas & Electric Company, serving Oklahoma City and a large number of other communities with electricity, had organized a sales development department to assist merchants and dealers in taking over the market. This new department has been active since last July and during the pre-holiday season organized a co-operative dealers' campaign to feature electric toasters, percolators and waffle irons. Every possible effort was made to interest merchants and dealers. A special sales school was held by the company. Large joint newspaper advertisements were run.

The department succeeded in securing the participation of 101 stores in eleven communities. In the majority of towns sufficient dealer interest could not be aroused to make the effort worth while.

The campaign was considered a success. A total of 6,183 units were sold, amounting to $27,746 retail sales value. Units were divided as follows: Toasters, 1,896; percolators, 1,452; waffle irons, 2,835.

Accurate records were kept and a study of the division of business among the various kinds of stores is decidedly interesting. Results show how the different kinds of retail establishments fared relatively in the toaster-percolator-waffle iron drive:

Distribution of Sales with Utility Not Merchandising

Type of Store	No. of Stores	Units	Units per Store	Retail Value	Unit Price	Per Cent Units	Sales Value
Chain and mail...	17	3,123	184	$7,297	$2.34	50.5	26.2
Department.....	9	1,230	137	6,890	5.06	19.8	24.8
Electrical.....	29	633	22	5,447	8.60	10.2	19.6
Drug.....	21	524	25	2,413	4.60	8.4	8.74
Hardware.....	12	302	25	2,110	6.98	4.8	7.62
Jewelry.....	2	173	87	2,281	13.19	2.7	8.21
Furniture.....	7	101	14	653	6.46	1.6	2.35
Music.....	2	65	33	480	7.38	1.05	1.73
Auto supply.....	2	32	16	174	5.47	0.53	0.63
	101	6,183	61	$27,746	$4.49	100.00	100.00

These figures certainly tell their own story. They show that the chain and mail order stores, representing only 17 per cent of the stores participating, acquired more than 50 per cent of the unit volume, but that the merchandise sold was decidedly cheaper than that handled by the other outlets. Department stores, representing but 9 per cent of the stores, sold about 20 per cent of unit volume at considerably higher prices, while a participation of 29 per cent electrical stores sold only 10 per cent of the units, but substantial prices brought up their revenue to a good figure.

Interesting, indeed, is the fact that hardware and furniture stores combined, representing about 19 per cent of total stores, sold but 6.5 per cent of unit volume. The hardware stores ran considerably better than the furniture stores, and their fairly high unit prices gave them a fair percentage of dollar volume. The furniture stores, it is apparent, did not do at all well.

It was the furniture and hardware people who figured prominently—at least were made to appear so—in the campaign which put the anti-merchandising act on the Oklahoma statute books.

These facts tend to sustain the utility opinion that putting the latter out of business will not necessarily increase the appliance sales of independent merchants and dealers; that the business will probably gravitate to the low-priced items offered by the chain and mail order stores, and that in general there will be a reduction in price and quality of appliances not at all acceptable to the ordinary merchant, dealer or utility company. Will the independent merchant and dealer be better off under such circumstances?

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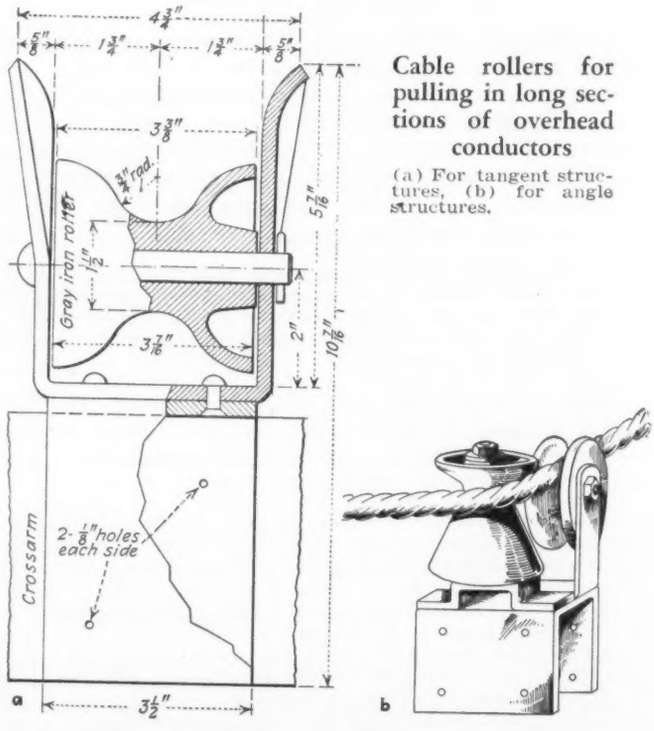
Cable Rollers Speed Conductor Stringing

During the past two years Compañia Mexicana de Construcciones, S. A., has constructed at Torreon, Mexico, several hundred miles of 13,200-volt, three-wire, overhead distribution lines using aluminum cable, steel-reinforced conductors. Crossarms and pin type insulators were used on tangent and small angle structures and vertically arranged strain insulators were used on corner and large angle structures. The nominal span length on these lines was approximately 400 ft.

Among the various problems involved in the preparation of specifications for the construction of these lines was that of devising a method for economically stringing the conductors. It was recognized that the use of a cable-stringing block in connection with pin type insulator construction had many disadvantages, particularly that of lifting the conductor from the block located under the crossarm to the pin insulator. A cable roller was developed by the Western Block Company in co-operation with the engineers of Electric Bond & Share Company. This type of cable roller operated so successfully on tangent structures that a second type of cable roller was developed for use on small angle structures.

To date cable rollers have been used only on tangent structures and cable-stringing blocks have been used at the angle structures. The use of these cable rollers made it possible readily to string and sag-in with one pull as much as 7 km. of No. 4, 5 km. of No. 1/0 and 3 km. of No. 3/0 A.C.S.R. (one kilometer = 0.6214 mile). In pulling the above lengths, a 4-in., two-sheave type block with ½-in. rope was found to have adequate strength. Much longer lengths of cable could have been strung and sagged-in had the newly developed angle cable roller been available or if heavier pulling equipment had been employed. Based on the experience with the tangent type rollers the construction engineers estimate that by the use of a power winch and cable rollers of both types as much as 20 km. of No. 4, 15 km. of No. 1/0 and 10 km. of No. 3/0 A.C.S.R. could be successfully pulled up and uniformly sagged-in with one set-up.



Cable rollers for pulling in long sections of overhead conductors

(a) For tangent structures, (b) for angle structures.

The original tangent type cable rollers were designed with an ordinary steel pin bearing. It was found that dust and grit entered the bearings and caused the pins to wear down, with the result that some of the rollers would not turn as freely as others. This was particularly noticeable when new rollers were used with rollers that had seen considerable service, and in this case it was difficult to obtain uniform sags. To overcome this

difficulty the manufacturer provided spools equipped with dust-proof ball bearings.

The use of cable rollers permits the stringing of long lengths of cable; reduces the time required for stringing, and the cost; eliminates damage to the conductors and the crossarms and insures uniform sagging. Also, after the cable has been pulled to the proper sag it is very easy to transfer it to the insulator.

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New Swiss Locomotive Hauls 1,500-Ton Train

A new type of electric locomotive has just recently been placed in regular service on the Gotthard line of the Swiss Federal Railways to enable the haulage of heavier trains, whether they be in express, passenger or freight service. It has more than doubled the hauling capacity of existing locomotives, two of which are required to haul a 400-500-metric-ton train over the long 27 per cent grades.

The locomotive, composed of two articulated sections, weighs 245 metric tons, has a maximum tractive effort of 110,000 lb., and can haul the following weight trains: 750-ton freight trains over 27 per cent grade at 50 km. per hour, 600-ton passenger trains over same grade at 62 km. per hour and 1,500-ton express trains over level routes at 100 km. per hour.

Eight single-phase sixteen-pole commutator motors are connected to as many drivers. A starting current of nearly 20,000 amp. is required on the secondary side of the transformer. By using a 28-step, 15-kv. tap switch on the primary side of the transformer it was possible to reduce the currents handled in the ratio of 30:1, thereby greatly reducing the weight and cost of the complete control equipment and the number of contactors. The mechanism can be operated by hand in an emergency.

Other features of the locomotive include the recuperating brake system and an arrangement for increasing the adhesion of the drive wheels 7½ per cent during starting by relieving the weight on the middle pony axle.

The locomotive was built by the Swiss Locomotive & Machine Works and the electrical equipment was designed and built by Brown, Boveri & Company, Ltd.

READERS' FORUM

'What About Specifications, Guarantees, Free Consultations?"

To the Editor of the ELECTRICAL WORLD:

I have just looked over an article by M. M. Samuels in the January 9, 1932, issue of the ELECTRICAL WORLD entitled "What About Specifications, Guarantees, Free Consultations?" In the opening paragraphs of this article there are two statements which are open to question. The first of these is:

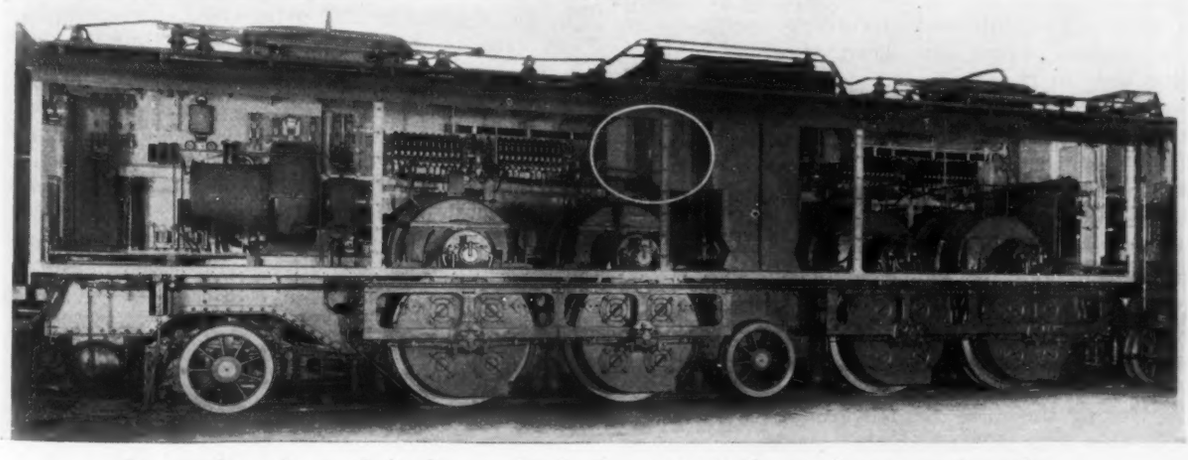
> Purchasers' engineers and manufacturers' engineers seldom meet face to face or even in direct correspondence. The purchaser's engineer transmits his information through a purchasing agent and the manufacturer's engineer through a sales representative. Of late the two classes of engineers have been having a better opportunity to become acquainted with one another, particularly through committee activities in the industry.

This statement may be literally true of relations between purchasers' engineers and those of small manufacturers, but it is not true of those that exist between the purchasers' engineers and those of the leading electrical manufacturers.

In the company with which the writer is associated a group of engineers is employed whose duty it is to maintain close contact with customers' engineers, to learn the requirements of their particular systems and to see that the equipment furnished has the proper characteristics to give satisfactory service on the various systems. These engineers are designated general engineers. Closely associated with the general engineers are groups of engineers whose activities are of a research character. Their duty is to analyze systems and equipment with a view to finding out what particular characteristics should be incorporated in the equipment to give the best performance on any particular system.

The relation between these engineering groups and the customers' engineers has been marked by a spirit of close co-operation and cordiality. This is not to be wondered at since the motivating spirit of the whole group is to obtain the best engineering results.

The second statement occurs in the second paragraph of the article and is as follows:



One section of new Swiss locomotive having 110,000 lb. maximum tractive effort

On the other hand, the purchasers, and most particularly large-scale purchasers and their organizations (such as, for instance, the N.E.L.A.) are likewise conducting on a large scale research and investigations such as lightning and short-circuit studies, which cannot be conducted in a manufacturer's laboratory. The manufacturers use the results of these investigations to improve existing apparatus and to develop new apparatus.

This statement is entirely misleading. The writer has taken an active part in a large number of field studies of various kinds during the last ten years and therefore feels qualified to discuss the matter.

The necessity of considering the stability of large systems was first brought to the attention of the industry by the manufacturers' engineers. The first field tests were undertaken with the co-operation of the Pacific Gas & Electric Company. For these tests, which were carried out under the direction of the writer, special instruments, such as the instantaneous watt oscillograph, the average value watt oscillograph, the polyphase power oscillograph and other high-speed recording instruments, had to be designed and were used for the first time on these investigations. The results of these field tests were analyzed by the manufacturer's engineers and other field tests were carried out in co-operation with various individual public utilities to obtain further information.

Most of the general analytical studies in connection with the problem of stability have been carried out by the two leading manufacturers of electrical machinery and the theory and methods of calculation have been presented to the electrical industry in the form of papers. In addition to these analytical methods two other notable contributions to the science of system design and planning arose out of these studies: (1) The automatic recording oscillograph, which enables operating companies to study the requirements of their system through its operation under fault conditions. (2) The a.c. calculating board, which has been made available to public utilities for use in connection with large projects.

The joint development and research committee of the N.E.L.A. and American Telephone & Telegraph Company have assisted in the analytical work of stability by getting together data on the network constants such as zero sequence impedance and cable constants.

The behavior of circuit breakers under operation forms an important part of the problem of system stability and system design. Many field tests have been carried out by the manufacturers' engineers in co-operation with those of different public utilities with mutual satisfaction, both sides having profited equally as a result of such tests. The automatic recording oscillographic devices mentioned above have been of great value in conducting tests of this character.

With regard to lightning field investigations there was very little activity until the invention of the klydonograph by J. F. Peters. Following the development of this instrument extensive field tests of lightning surges on transmission lines were made by the leading electrical manufacturers with the co-operation of public utility companies throughout the whole country. The results of these studies have been presented to the industry in papers before the A.I.E.E. and through articles in electrical periodicals. In 1927 Dr. Harald Norinder was invited by the Westinghouse company to visit this country. During this time he delivered lectures on his lightning studies with the cathode-ray oscillograph before the A.I.E.E., the Franklin Institute and other scientific bodies. Following this visit more elaborate and extensive lightning studies were planned and carried out by the engineers of the two leading manufacturers with the co-operation of various utilities, among which might be mentioned the Knoxville Power Company, a subsidary of the Aluminum Company of America; Pennsylvania Power & Light Company; Public Service Electric & Gas Company; American Gas & Electric Company; Public Service Company of Northern Illinois; Arkansas Power & Light Company.

In these tests the cathode-ray oscillograph played the leading rôle, but the klydonograph was used to supplement the information obtained by the cathode-ray oscillograph and new instruments using the principle of the klydonograph were designed and used, such as the direct stroke recorder, current surge recorders of various types and instruments to determine the location and distance of thunderstorms.

During the years 1929 and 1930 these field investigations of lightning were further expanded and studies were made of the behavior of transmission lines with artificial lightning surges. To carry out these investigations special surge generators were designed and built by the manufacturers. These tests with artificial surges corroborated theoretical methods of computing surge constants of transmission lines and in addition gave valuable information on attenuation of surges, the effect of tower footing resistance and the characteristics of artificial grounds.

The subcommittee on lightning of the transmission committee of the A.I.E.E. has taken an active interest in fostering these lightning investigations and the results have been presented in symposiums initiated by this subcommittee. This committee also started the work of collecting statistical data with reference to the lightning behavior of transmission lines throughout the country, correlating the performance of lines with the type of construction, position of ground wires and character of tower footings, etc. I understand these statistical studies have been taken over by an N.E.L.A. committee, and since work of this character is much more the province of the N.E.L.A. than of the A.I.E.E. I feel that this is a move in the right direction.

It would take too long to enumerate in a letter all the benefits that have been derived from these lightning investigations. It suffices to point out that during the progress of the work the most cordial relations existed between the two groups of engineers and full credit should be given to both groups for making this information available to the whole electrical industry.

In conclusion, it seems to me essential that the manufacturers' engineers in contact with engineers of the public utilities shall have a thorough understanding of the operation of the public utilities systems, as this knowledge is required by the manufacturers in order that they may develop machines and appliances which will give satisfactory performance on these systems. The manufacture and sale of electrical machinery is not a deal over the counter, but is more like the business of a custom tailor where the tailor studies his customer's requirements with a view to producing something which will meet those requirements and the prosperity of his business depends on the quality of service he gives.

CHARLES FORTESCUE,
East Pittsburgh, Pa. Consulting Transmission Engineer.

Men of the Industry

Westchester Officers Named Executives in Yonkers Utility

Eugene H. Rosenquest, who was recently elected president of the Yonkers Electric Light & Power Company, as announced in the February 6 issue of the ELECTRICAL WORLD, is a veteran in the service of the New York utility companies. Entering the employ of the Bronx Gas & Electric Company as superintendent in 1896, he was made vice-president and general manager in 1898. In the spring of 1901 he was elected president of the Bronx Gas & Electric Company and occupies that position at the present time. It was in 1926 that he became president of the Westchester Lighting Company. Besides being president and a director of the

E. H. Rosenquest

Westchester Lighting Company, the Bronx Gas & Electric Company and the Yonkers Electric Light & Power Company Mr. Rosenquest is a director of the National Coke & Coal Company, Tarrytown Terminal Company, Bronx Savings Bank and Bronxville Trust Company. He is a member of the National Electric Light Association.

E. P. Prezzano, who became vice-president of the Yonkers utility, entered the employ of the Standard Gas Light Company in 1902 and in 1904 became identified with the Consolidated Gas Company of New York. He became a branch manager of the Consolidated Gas Company in 1918 and assistant general commercial manager in 1922. He was made secretary of the Westchester Lighting Company in 1924 and vice-president two years later. He is in charge of the commercial department, transportation department, sales and the

E. P. Prezzano

public relations of both the Westchester Lighting Company and Yonkers Electric Light & Power Company. Mr. Prezzano is a member of the American Gas Association, National Electric Light Association, Society of Gas Engineering of New York City, New York Electrical Association and other business and professional associations. He has been active in committee work in several of the national gas and electric associations and has served as chairman of several important committees during the past several years.

Stuart Wilder, new vice-president of the Yonkers Electric Light & Power Company, is also a veteran in the em-

Stuart Wilder

ploy of the electrical properties in New York and vicinity, though for a short time his public utility career was halted to permit him to pursue other interests. Starting with the Westchester Lighting Company in 1903 as assistant chief engineer of the electric department, he was made vice-president and general manager of the Northern Westchester Lighting Company two years later, and subsequently vice-president and general manager of the Peekskill Lighting & Railroad Company. In 1912 he was named chief electrical engineer of the Westchester Lighting Company, retaining the executive offices with the other utility organizations. It was in 1919 that he resigned these three positions to engage in another field. He returned, however, to the public utility industry as electrical engineer for the Bronx Gas & Electric Company and after several promotions was appointed vice-president in 1928. He assumed a vice-presidency in the Westchester company one year later. Mr. Wilder is a past-president of the Empire State Gas and Electric Association and a member of the American Institute of Electrical Engineers and the American Gas Association.

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A. I. WHITEHEAD, manager of the Alhambra district of the Southern California Edison Company, Ltd., for the past eleven years, has been appointed manager of the company's central division to succeed the late Myron McNeal. Mr. Whitehead is a veteran in the Edison company organization. He joined the company in Los Angeles as a salesman in 1915 and has held a number of important sales and district executive positions.

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W. H. SPENCER, B.Sc., M.E., E.E., who has been acting as assistant secretary of Montreal Light, Heat & Power Consolidated for some time, will in the future specialize in safety engineering. While serving as assistant secretary he supervised accident prevention work. Mr. Spencer was formerly identified with the electrical engineering division of the company. He is a graduate of McGill University in electrical and mechanical engineering. C. C. PARKES has been appointed assistant secretary of the company.

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ALBERT G. CAGE, since 1919 assistant general agent for the Southern Sierras Power Company, Riverside, Calif., has been placed in charge of its new rate department. Mr. Cage entered the employ of the power company in 1914 as a clerk in the engineering department and during the same year was transferred to the commercial department. Following his service in the World War he returned to the Southern Sierras company in 1919 and was made assistant general agent. In 1921 he took a furlough to accept a position with the California Railroad Commission, returning to the commercial department as assistant general agent during the following year, a position he has held until his present advancement.

L. M. Klauber Directs Operations in San Diego

Laurence M. Klauber, who was elected vice-president in charge of operation of the San Diego Consolidated Gas & Electric Company, as announced in the February 13 issue of the ELECTRICAL WORLD, became associated with the San Diego utility in 1911 in a sales capacity. After spending several months in the

commercial department, he assumed the duties of engineer in charge of the record department. From 1914 to 1918 he served as superintendent of the electric department, later was appointed assistant general superintendent and subsequently general superintendent. For the past nine years he held the title of vice-president and general superintendent. Mr. Klauber was born in San Diego, Calif., in 1883 and received the degree of A.B. in electrical engineering from Stanford University in 1908. From 1908 to 1910 he took the Westinghouse graduate apprentice course.

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J. E. NORTH, of the Cleveland Electric Illuminating Company, again will head activities of the Electrical League of Cleveland in 1932, serving his ninth consecutive term in office.

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HARRY R. WOODROW, electrical engineer of the Brooklyn Edison Company, and GEORGE L. KNIGHT, mechanical engineer, were elected vice-presidents of the company at the first meeting of the new directorate held this week. Mr. Woodrow will be in charge of electrical operations and Mr. Knight mechanical operations.

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DR. WILLIAM D. COOLIDGE, associate director of the research laboratory of the General Electric Company at Schenectady, was made the recipient of the Washington award for 1932 in recognition of devoted, unselfish and pre-eminent service in advancing human progress. The presentation was made at a dinner and reception at the Hotel Sherman, Chicago, February 24. Dr. Harry Woodburn Chase, president of the University of Illinois, delivered the principal address of the evening, evaluating the importance of research in the present social order. Among the best-known contributions of Dr. Coolidge are ductile tungsten for lamp filaments, wrought tungsten for contacts and X-ray targets, the hot cathode X-ray tube, various types of X-ray generating equipment, the "C" tube for submarine detection and signaling and the cathode-ray tube. The Washington award was founded sixteen years ago by John Watson Alvord and it is administered by the Western Society of Engineers.

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JOHN E. BARKLE has been appointed general manager of the South Philadelphia Works of the Westinghouse Electric & Manufacturing Company, located at Essington, Pa. Upon the completion of his education at Dickinson College, in 1901, Mr. Barkle became associated with the Westinghouse organization.

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C. J. FECHHEIMER, formerly connected with the power engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has opened consulting engineering offices in Milwaukee, Wis. Mr. Fechheimer is the author of technical literature on the subject of electrical machinery and at the present time is giving a course of lectures on that subject under the auspices of the Milwaukee Extension Division of the University of Wisconsin.

M. B. Fowler Elected to New Executive Position

M. B. Fowler, recently elected vice-president and treasurer of the San Diego Consolidated Gas & Electric Company, as announced in the February 13 issue of the ELECTRICAL WORLD, began his career as messenger and clerk of the Bank of Commerce in San Diego in 1898, and became book-

keeper there in 1900. In 1901 he went with the San Diego Flume Company as secretary. He became associated with the San Diego Consolidated Gas & Electric Company in 1904 as bookkeeper and then secretary. In 1907 he was made treasurer and was elected to the board of directors, and in 1921 became a member of the executive committee. Mr. Fowler is a native of Santa Clara, California.

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OBITUARY

BERNARD GOODWIN GOWARD, solicitor for the Vancouver Island branch of the British Columbia Electric Railway, died at his home, Cadboro Bay, Victoria, B. C., recently. Mr. Goward was born in England 62 years ago and is a brother of A. T. Goward, Vancouver Island vice-president of the British Columbia Electric Railway.

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CHARLES B. HURLEY, prominent in business and civic life of Tacoma for 43 years, died in that city January 30, at the age of 72. Mr. Hurley came to Tacoma in May, 1889, to become general manager for the Tacoma Light & Water Company. In 1903 he organized the Hurley-Mason Company, general contractors, and constructed many of the larger building projects in Tacoma, including the construction of Fort Lewis during the World War. Mr. Hurley was at one time one of the owners of the Tacoma Gas & Electric Light Company, disposing of his interests later to engage solely in contracting work. He was born in Philadelphia, Pa.

A. M. NIPPER, for the past 28 years superintendent of the municipal water works and light and power plants in Hannibal, Mo., died in that city January 28 of pneumonia. Mr. Nipper was 73 years of age.

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BENJAMIN N. JOHNSON, prominent lawyer of Boston, Mass., died in Lynn February 19, after an illness of several months. Mr. Johnson's interests were varied. He was vice-president of the Lynn Gas & Electric Company, of the Essex Trust Company of Lynn, the Lynn Institute for Savings and a director of the Atlantic National Bank of Boston and the Boston Woven Hose & Rubber Company. He was president of the Carver Cotton Gin Company. In addition to these industrial activities, Mr. Johnson was for six years a member of the Lynn School Board and was president-general of the Sons of the American Revolution, president of the Lynn Historical Society and chairman of the Metropolitan Improvement Commission. He was 75 years of age.

Trade News

C. C. Moore & Company, engineers, and the Babcock & Wilcox Company have announced the removal of their offices February 15 to their own building at 450 Mission Street, San Francisco.

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Lincoln Electric Company announced that B. F. McIntyre is now connected with the Chicago office in charge of motor sales for the Chicago district. Mr. McIntyre was formerly with the Industrial Controller Company of Milwaukee. Fred Archer, formerly president of Fred Archer, Inc., has been appointed to the Philadelphia office of the company. He is in charge of motor sales for this district. Mr. Archer was with the White Motor Company and the Kelly-Springfield Tire Company before organizing his own company.

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E. H. Wilcox, manager of the export division of the Kelvinator Corporation, announces that, effective February 1, his division took over the entire export distribution for all products of the Liquid Cooler Corporation, formerly handled in the export field by Estes Company of New York.

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Sun-Up Lamp Works, Inc., for the past seven years manufacturer of incandescent lamps in New York State, has acquired a plant at Monson, Mass. The plant will be reconditioned, with full production anticipated by September 1. The New York plant will be sold.

Net earnings of the United Engineering & Foundry Company for the year ended December 31, 1931, after all expenses, royalties, depreciation and federal taxes, amounted to $953,708, equal, after preferred dividends, to $2.13 per share on 416,118 shares of common stock. This compared with net of $2,114,359, or $4.86 a common share, after preferred dividends in 1930.

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Electromaster, Inc., announces the appointment of Trilling & Montague as "Electrochef" distributor for eastern Pennsylvania, Delaware and southern New Jersey.

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Chicago Electric Manufacturing Company reports net profit of $2,959 after all charges for the year ended December 31, 1931. This compared with a net loss of $23,676 in 1930. As of December 31, current assets amounted to $357,051 and current liabilities $20,235, compared with current assets of $343,098 a year previous.

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The number of holders of Westinghouse Electric & Manufacturing Company common and preferred stock at the end of 1931 was 53,079, a new high record for the company, and an increase of 4,624 over the 48,455 stockholders at the end of 1930.

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Corning Glass Works announces the appointment of J. E. Redmond Company, with offices in Phoenix, Ariz., to cover the states of Arizona and New Mexico; L. B. Graves, with offices in Minneapolis, Minn., to cover the states of Wisconsin, Minnesota, North and South Dakota, and J. Q. Lalor, with offices in Denver, Colo., to cover the states of Colorado and Wyoming.

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Chain Belt Company, Milwaukee, Wis., has recently issued a book covering its new line of Rex roller chains and sprockets. The book is amply illustrated with charts and diagrams showing the operations of these various types of chains and equipment.

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W. N. Matthews Corporation, St. Louis, Mo., has appointed W. G. Robertson of Richmond, Va., as its representative for a new territory consisting of the entire state of Virginia, eastern Kentucky and southwestern West Virginia. After a connection with the General Electric Company Mr. Robertson joined the Phoenix Utility Company in New York in 1925. He opened the Atlanta office for the Pacific Electric Manufacturing Company in 1928 and for the past four years has been actively engaged in sales engineering work on high-tension switching equipment for it.

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General Electric Company has just issued a booklet on electric steam generators. It gives a complete and thoroughly illustrated description of those devices for generating high- and low-pressure process steam as built by the General Electric Company. Typical installations are described and illustrated. The booklet goes thoroughly into the applications and discusses the advantages of electric steam generators in general.

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6,640-HP. LOCOMOTIVE FOR SWISS RAILWAYS

Brown, Boveri & Company, Ltd.

One of the most powerful electric traction units ever constructed, this 112-ft. articulated locomotive has just been placed in operation. It has a maximum tractive effort of 110,000 lb. and a maximum speed of 62 m.p.h. Most notable of engineering features are the regulation of energy on the primary side of the transformers and the provisions for increasing rail-to-driver adhesion by raising the pony axles.

New Equipment Available

Mercury Vapor Lamp with Positive Starting

The development of a new circuit in the research laboratories of the General Electric Vapor Lamp Company, involving the use of a copper-oxide rectifier to supply direct current for shifter action, has, it is said, produced not only quick starting but positive starting each time for the new model of Cooper-Hewitt lamp. The starting of the new model is said to be twice as fast as has heretofore been possible.

Other features include the elimination of projections, thus permitting a straight line tube; insulated screw base terminals, easily attached by hand; location of the negative terminal to prevent rotation of the tube and possible burn-outs; greatly improved reflector, auxiliary equipment which overcomes the bad effects of line voltage variations, absorbing variations as great as 10 per cent without difficulty, and ballast coils protected by metal shields.

The lamps are now made in two types, vertical and horizontal, to take advantage more fully of the new design improvements, particularly as regards the negative terminal. General Electric Vapor Lamp Company continues its policy of offering a 30-day trial installation without obligation to buy.

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Water Level Recorders Supplant the Gage Glass

Boiler drum water level recorders and indicators which operate on the difference in level obtained by making two connections to the water column or boiler drum are announced by the Bailey Meter Company, Cleveland, Ohio. One connection is made to the water space and the other to the steam space where a constant water head is maintained in the connection by means of a steam-condensing radiator and a reservoir. The variable head or water space connection is applied over a mercury sealed bell and the constant head connection is applied to the inside of this bell. As the boiler water level rises or falls, the mercury sealed bell falls or rises, and this motion is transmitted to the recording pen by a forked lever and a spindle which turns in pressure-tight bearings. A reversing linkage is employed between the spindle and recording pen so that the pen moves upward as the water in the boiler drum rises and moves downward as the water level drops.

The water level recorder may be incorporated with a feedwater flow meter to record the two related factors on one chart for easy comparison. Remote indicators or recorders operating from the main recorder can be placed at other points, if desired.

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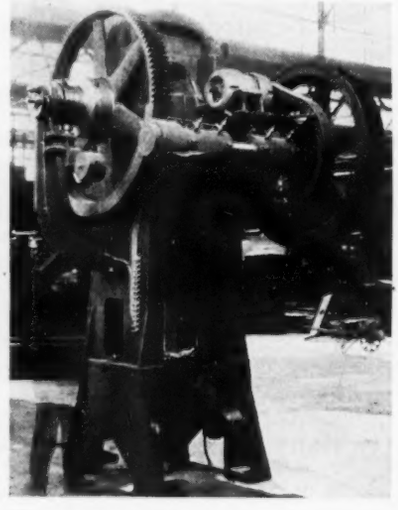
Punch Press Motors Made More Efficient

A line of induction motors especially adapted for punch presses and machinery with similar operating characteristics, ranging in sizes from 3.4 hp. to 200 hp., has been announced by the Reliance Electric Engineering Company, Cleveland, Ohio. The chief advantages of the motors are that the installation and operating costs are lower and the power factor is considerably improved. A much smaller motor can be used, resulting in power savings which for many applications amount to as much as half that required for ordinary induction motors.



In the design of these motors the flywheel, with which all punch presses are equipped, was especially considered. During the unproductive part of the operating cycle they deliver power to the flywheel. When work is being done they slip and permit the flywheel to carry the brunt of the load. These motors develop a starting torque of approximately 225 per cent and have a slip of 8 to 12 per cent. Normal starting current is required.

Capacitor Motor Has Internal P.F. Correction

A method of applying capacitors to polyphase induction motors which is said to involve several distinct advantages is announced by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. Capacitors are usually applied to polyphase induction motors by connecting them across the motor terminals. This produces a high power factor in the power line, but does not affect the motor characteristics or the power factor in the motor proper. This recent development, however, causes the condenser reactive current to flow through the windings of the motor, thereby producing a high power factor within the motor.

The Noel polyphase capacitor motor offers improved starting and running characteristics. The outstanding feature is that it operates at practically unity, 100 per cent power factor at all loads, whereas the ordinary induction motor has a lagging power factor around 70-80 per cent and down to 10-20 per cent on light loads. The motor is designed to give 80 per cent power factor leading at full load and leading power factors up to 15 per cent leading at no load, which would make it an extremely efficient device for power-factor correction.

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Double Disk Clutch Increases Torque Rating

A simple magnetic friction clutch having contact faces on both sides of a spring disk which are squeezed between the magnet and armature elements when the coil is energized is announced by the Dings Magnetic Separator Company, Milwaukee, Wis. Theoretically the power transmission of this clutch is double that of a single friction contact face, but actually it is of approximately 75 per cent greater torque with the same magnet strength. Within certain physical limits having 175 per cent torque of a single contact face is of material advantage.

All provisions are made for adjustment to compensate for wear of contact faces. Light springs on the armature holding bolts serve to expel the armature when coil is de-energized, thus assuring ample clearance between the two clutch elements.

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A LIGHT-WEIGHT, UNDERWRITERS' LISTED TRANSFORMER for use with suspended luminous tube signs is announced by General Electric Company. Weight is eliminated by filling only the central portion of the case, which incloses the core and coils, with compound.